AN ESSAY ON THE WEATHER; WITH REMARKS ON THE SHEPHERD OF BANBURY'S RULES FOR JUDGING OF IT'S CHANGES; AND Directions for preserving Lives and Buildings from the fatal Effects of Lightening.

INTENDED CHIEFLY FOR THE USE OF HUSBANDMEN.

BY JOHN MILLS, ESQ. F.R.S.
Honorary Member of the Dublin Society, of the Royal Societies of Agriculture of Paris and Rouen, of the Oeconomical Society of Berne, and of the Palatine Academy of Sciences and Belles-Lettres.

THE SECOND EDITION, IMPROVED.

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M DCC LXXIII.

TO

THE REVEREND

GEORGE TILSON, A. M.

OF RICHMOND, IN SURRY,

A GENTLEMAN SKILLED IN

BOTANY,

A LOVER AND JUDICIOUS ENCOURAGER OF

AGRICULTURE,

AND A DISTINGUISHED FRIEND TO

THE LAUDABLE PURSUITS OF

ALL MANKIND;

THIS SECOND EDITION OF THE FOLLOWING ESSAY

IS RESPECTFULLY INSCRIBED,

BY

HIS MUCH OBLIGED, AND

MOST OBEDIENT SERVANT,

LONDON, October 12, 1772.

JOHN MILLS.

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ESSAYS

MORAL, PHILOSOPHICAL,

AND

POLITICAL,

On the following Subjects;

VIZ.

I. On Philosophy and Philosophers.
II. On Projects.
III. On Love and Jealousy.
IV. On Commerce and Luxury.
V. On Agriculture.

By the AUTHOR of this ESSAY.

N. B. The Authors of the Critical Review for January, 1772, conclude their Account of this Work, as follows: viz. "We may ſay with Juſtice of the Whole, that they diſcover the Author to be a Perſon of Learning, Taſte, and Philoſophical Sentiment; and the Third Eſſay is particularly ingenious, and contains many juſt obſervations on Modern Manners.

PREFACE.

THINKING it would be wrong in me to be the firſt publiſher of another perſon's diſcoveries, eſpecially when there was reaſon to preſume that the diſcoverer himſelf might be induced to communicate them to the public; this eſſay has lain by for ſome years, in expectation that my highly reſpected friend, Dr. Benjamin Franklin, would one day favour the world with what he had before imparted to me concerning the affinity between lightening and the electrical fire, and the means of preſerving houſes from the dangers of the former. That ſcruple being now removed, by the Doctor's late publication of his "Experiments "and Obſervations on Electricity," with the addition of his "Letters and "Papers on various philoſophical ſub-"jects," I at length give the following ſheets (originally intended as a part of

my Treatiſe on Huſbandry) in hopes that they may be of ſome ſervice to that eſſentially neceſſary, but too much neglected claſs of mankind, huſbandmen.

The advantages which may ariſe from a fore-knowledge of the changes of the weather are ſo frequently pointed out in the following ſheets, that I cannot well do more here, than repeat my advice to farmers, to turn their attention to obſervations of this kind more than they have generally done, with a probable expectation of their reaping *a crop* of uſeful knowledge: for though ill-founded predictions have caſt a diſcredit upon the ſtudy of, or attention to, the changes of the weather; yet it is hard to ſay to what degree of perfection men who make the works of nature their ſtudy may arrive, both in tracing the cauſes of the alterations of the weather, and in fore-ſeeing the ſucceſſions of it's changes.---The fiſherman, who has been long practiſed in his buſineſs, ſeldom unfurls his ſails when a ſtorm is near, owing to his conſtant obſervation of the ſky: and were farmers equally attentive, and had once acquired as

much judgment in this matter, they would be as ſeldom overtaken by unlooked for changes.

They muſt not however at all times look ſo high, as to neglect what paſſes around them on the ſurface of the earth. The beginning vegetation of plants, eſpecially of the natives of each country, is a kalendar well worthy obſervation, as a directory of the ſeaſons proper for certain works in the ſpring: nor ſhould the accidents which happen to even the leaſt uſeful plants be neglected, becauſe they may afford hints of what ſhould be done to prevent the like evils in plants of greater utility.

Linnæus and his diſciples have given excellent inſtructions on this head. One of them in particular, Mr. Harold Barck, in his very ingenious Diſſertation on the Foliation of Trees, preſented in 1753 to that great, and hitherto unrivalled ſchool of natural hiſtory, the univerſity of Upſal, under the preſidence of the excellent Linnæus, tells us it was then the fourth year ſince that illuſtrious botaniſt exhorted his countrymen to obſerve with all care and diligence, at

what time each tree expands it's buds, and unfolds it's leaves; imagining, and not without good reaſon, that his country, and the ſame is equally applicable to every other, would, ſome time or other, reap ſome new, and perhaps unexpected benefit, from obſervations of this kind made in different places.

As one of the apparent advantages, he adviſes the prudent huſbandman to watch with the greateſt care the proper time for ſowing; becauſe this, with the divine aſſiſtance, produces plenty of proviſion, and lays the foundation of the public welfare of the ſtate, and of the private happineſs of the people. The ignorant farmer, continues he, tenacious of the ways and cuſtoms of his anceſtors, fixes his ſowing-ſeaſon generally to a month, and ſometimes to a particular day, without conſidering whether the earth be prepared to receive the ſeed: from whence it frequently happens, that the fields do not return what might be expected, and that what the ſower ſows with ſweat, the reaper reaps with ſorrow. The wiſe œconomiſt ſhould therefore fix certain ſigns

whereby to judge of the proper time for ſowing. We look up to the ſtars, and, without reaſon, ſuppoſe that the changes on earth will anſwer to the heavenly bodies; entirely neglecting the things which grow around us. We ſee trees open their buds, and expand their leaves; from whence we conclude that ſpring approaches, and experience ſupports us in the concluſion: but no body has yet been able to ſhew what trees Providence intended ſhould be our kalendar, ſo that we might know on what day the countryman ought to ſow his grain. No one can deny but that the ſame power which brings forth the leaves of trees, will alſo make the grain vegetate; nor can any one juſtly aſſert that a premature ſowing will always, and every where, accelerate a ripe harveſt. Perhaps therefore we cannot promiſe ourſelves a happy ſucceſs by any means ſo likely, as by taking our rule for ſowing from the leafing of trees. We muſt, for this end, obſerve in what order every tree puts forth it's leaves, according to it's ſpecies, the heat of the atmoſphere, and the quality of the

ſoil. Afterwards, by comparing together the obſervations of ſeveral years, it will not be difficult to determine, from the foliation of trees, if not certainly, at leaſt probably, the time when annual plants ought to be ſown. It will be neceſſary likewiſe to remark what ſowings made in different parts of the ſpring produce the beſt crops, in order that by comparing theſe with the leafing of trees, it may appear which is the moſt proper time for ſowing: nor will it be amiſs in like manner to note at what times certain plants, eſpecially the moſt remarkable in every province or country, blow; that it may be known whether the year makes a quicker or ſlower progreſs.

Linnæus's methods of carefully obſerving the foliation of trees, &c. would undoubtedly determine right the proper time for ſpring-ſowing; and Pliny, after mentioning the ſeveral conſtellations by which farmers were guided in his time, inſtructs the huſbandman with regard to autumnal ſowing, upon a principle ſimilar to that of our great modern naturaliſt. "Why,

" ſays he, (Lib. xviii. c. 25.) does the " huſbandman look up to the ſtars, of " which he is ignorant, whilſt every " hedge and tree point out the ſeaſon " by the fall of their leaves? This " circumſtance will indicate the tem- " perature of the air in every climate, " and ſhew whether the ſeaſon be early " or late. This conſtitutes an univer- " ſal rule for the whole world; becauſe " trees ſhed their leaves in every coun- " try according to the difference of the " ſeaſons. This gives a general ſignal " for ſowing; Nature declaring that " ſhe has then covered the earth againſt " the inclemency of the winter, and " enriched it with this manure."

Mr. Stillingfleet, who has given us a judicious tranſlation of ſeveral excellent pieces publiſhed by ſundry diſciples of the Linnæan ſchool, informs us, that he himſelf was told by a common huſbandmen in Norfolk, that when the oak catkins begin to ſhed their ſeed, it is a proper time to ſow barley: " And why," adds he, very properly, " may " not ſome other trees ſerve to direct " the farmer for the ſowing of other

" ſeeds? The prudent gardener never " ventures to put his houſe plants out " till the mulberry leaf is of a certain " growth." Heſiod, continues this gentleman, (Miſcellaneous Tracts, p. 147,) began to fix the proper ſeaſons for plowing, ſowing, &c. by the appearance of birds of paſſage, or of inſects, or by the flowering of plants: but we have no record of obſervations of this kind being made till Linnæus wrote. Heſiod ſays, that when the voice of the crane is heard over-head, then is the time for plowing; that if it ſhould happen to rain three days together when the cuckow ſings, late ſowing will then be as good as early ſowing; that when ſnails begin to creep out of their holes, and climb up plants, it is time to ceaſe digging about the vine.

There is a wonderful co-incidence, which probably takes place in all countries, between vegetation and the arrival of certain birds of paſſage. Linnæus ſays, that the *wood-anemone* (in Sweden) blows from the time of the arrival of the ſwallow; and Mr. Stil-

lingfleet finds by a diary which he kept in Norfolk for the year 1755, that the ſwallow appeared there on the 6th of April, and the *wood-anemone* was in bloom on the 10th of the ſame month. Linnæus obſerves, that the *Marſh-marigold* blows when the cuckow ſings; and Mr. Stillingfleet finds by his diary that the *Marſh-marigold* was in bloſſom on the 7th of April, and the cuckow ſung the ſame day.

The methods here hinted at deſerve the moſt ſerious attention of every lover of his country. A ſeries of obſervations of theſe kinds, properly made by intelligent perſons, in different parts, and afterward rightly compared and combined, would ſoon afford almoſt infallible rules to guide the huſbandman in one of the moſt important parts of agriculture. I cannot too ſtrongly recommend it to the public ſpirited inhabitants of the Britiſh dominions in particular, as a means by which the power and opulence of this happy ſtate cannot fail to be conſiderably increaſed, and the felicity of individuals to be conſequently confirmed.

The principal points neceſſary in the making of theſe obſervations are, 1ſt, That they be continued for a due length of time, and the *time* and *place* of obſervation be particularly ſpecified. 2dly, That they be made on the ſame *ſubjects:* and 3dly, That the *ſoil* and *expoſition* be carefully noticed and deſcribed, in order to their being duly compared with the field intended to be ſown. The neceſſity of being as exact as poſſible in this laſt article, will appear to every one who does but conſider, what all know, that the *north-wind*, *ſhade*, and a *moiſt ſoil*, hinder the leafing of trees, as much as a *dry ſituation* on the *ſlope* of a hill inclining to the *ſouth* promotes it.--- Another circumſtance which would greatly facilitate the application of theſe obſervations, is, to take the trees in their progreſſive order of leafing: for nature is always regular, and the guide would then be ſure.

The changes of the weather, and their effects on both the animal and the vegetable kingdom, are likewiſe an object which has been long purſued by the Royal Academy of Sciences, and

eſpecially of late years by the juſtly celebrated M. Duhamel, in his meteorological obſervations publiſhed annually in the Memoirs of that Academy.

The different ſocieties of agriculture inſtituted in the ſeveral foreign nations of Europe, have alſo taken up this ſubject: that of Berne in particular has likewiſe publiſhed annually obſervations of this kind: I ſhall here ſubjoin by way of appendix, an abſtract of thoſe of the year 1766, as a model worthy of imitation. In this abſtract, I ſay but little of the weather in Swiſſerland, becauſe the Berne journal of the barometer and thermometer would ſwell this work too much, and might be thought rather too local; though the reader would be ſurprized to ſee the ſimilarity in the motion of the barometer in that country and in this.

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AN ESSAY ON THE WEATHER.

INTRODUCTION.

THE many advantages arising to the industrious farmer from a foreknowledge of the changes of the weather, and the example set us by all the antient writers on husbandry, are sufficient inducements for my endeavouring to draw the attention of husbandmen to observations which must be so highly beneficial to them. It might indeed have been expected, that, considering the great improvements which have been made in natural philosophy in the two last centuries, an accurate account of the weather would ere now have been attained: yet the earliest authors who have

treated of huſbandry, ſeem to have eſtabliſhed more certain prognoſtics of the weather peculiar to their climates, than any have done for our's; though it may be preſumed that the operations of nature are ſet in a much clearer light to us, than they could be to them, by means of the many and great diſcoveries which the moderns have made. Perhaps philoſophers have not had opportunities, from their own obſervations, of laying down any certain rules of the changes of the weather, and either deſpiſed or neglected the remarks of illiterate country people. Such, it is ſuppoſed, was the ſhepherd of Banbury, whoſe *rules to judge of the changes of the weather* are the only obſervations of this kind that have been adapted to this country; the modern writers on huſbandry, who have ſaid any thing of the weather, and even that great reſtorer of natural knowledge, lord Bacon, having too ſervilely followed the antients.

Who the ſhepherd of Banbury was, we know not; nor indeed have we any proof that the rules called his were penned by a real ſhepherd: both theſe points are how-

ever immaterial: their truth is their beſt voucher. Mr. Claridge, who publiſhed them in the year 1744, ſince which time they are become very ſcarce, having long been out of print, tells us, that they are grounded on forty years experience, and thus, very rightly, accounts for the preſumption in their favour. "The ſhepherd, whoſe "ſole buſineſs is to obſerve what has a re- "ference to the flock under his care, who "ſpends all his days, and many of his nights "in the open air, under the wide-ſpread ca- "nopy of heaven, is obliged to take par- "ticular notice of the alterations of the "weather; and when he comes to take a "pleaſure in making ſuch obſervations, it "is amazing how great a progreſs he makes "in them, and to how great a certainty he "arrives at laſt, by mere dint of comparing "ſigns and events, and correcting one re- "mark by another. Every thing, in time, "becomes to him a ſort of weather-gage. "The ſun, the moon, the ſtars, the clouds, "the winds, the miſts, the trees, the flowers, "the herbs, and almoſt every animal with

" which he is acquainted, all theſe become,
" to ſuch a perſon, inſtruments of real know-
" ledge."

I ſhall occaſionally quote ſuch of the ſhepherd's rules as may tend to ſtrengthen or confirm my reaſonings, by facts; and endeavour to explain others of them on the principles of the lateſt diſcoveries, which Mr. Claridge was either unacquainted with, or neglected to notice,

But before I begin to ſpeak of the particular prognoſtics of the weather, and, with them, of the ſhepherd's rules, it may not be amiſs to give a conciſe and general account of the following articles, thereby to throw the greater light on the rules themſelves, as well as on my obſervations.

SECT.

SECTION I.

Of Clouds, Fog, Rain, Snow, Hail, Thunder and Lightening.

THE higher water is raiſed in the air, the farther it's parts recede from one another. In this caſe, they will not probably conſtitute water, but the primary particles or principles of water. When theſe particles are equally diſperſed in the atmoſphere, it is tranſparent: but when they deſcend again from the upper regions, and occupy ſmaller ſpaces, they aſſociate together, or form a moiſt vapour, and become clouds. The higher therefore water aſcends in the air, the more ſerene and dry the weather will be, and the more free from clouds. The atmoſphere is uſually heavieſt at this time; ſo that, in reality, as obſerved by Boerhaave, there is then more water in the atmoſphere, than when, by reaſon of the dryneſs below, people generally imagine there is leaſt in it. The ſnow ſeen on the tops of the higheſt mountains, ſhews to how great an height water riſes in the atmoſphere.

The following ſeem to be ſome of the chief cauſes of the aſcent of water and other exhalations into the air.

Firſt; Fire, whether culinary, ſubterraneous, or of the ſun. The ſubterraneous heat probably ariſes from the efferveſcence of different ſubſtances under ground, and ſometimes from their taking fire. Heat, from whatever cauſe it ariſes, renders many particles of water lighter than the lower air; they therefore aſcend till they come to air of the ſame ſpecific gravity, as is juſtly obſerved by M. de la Hire, in the Memoirs of the royal Academy of Sciences, for the year 1719.

Secondly; Great quantities of vapours riſe from fluids whoſe particles are put in a violent motion by any cauſe; as appears from the cloud conſtantly obſerved where there is a great fall of water.

The third, and ſeemingly the moſt general cauſe of the aſcent of vapours into the atmoſphere, is that power which the air has of attracting water, the particles of which being once ſeparated from the maſs, aſcend

with the air. Hence perhaps it is, that winds carry off great quantities of watery vapours, by bringing a greater number of particles of air into contact with the water. The air ſeems to have this effect independent of heat; for we find that in the ſevereſt winters, a great quantity of ſnow, and even of ſolid ice, evaporates into the air. This power is exerted very differently, according to the weight of the atmoſphere. When it is heavy, and the quickſilver in the barometer riſes high, then a great deal of water is taken up by the air: but when the quickſilver falls, or the atmoſphere becomes lighter, then the air drops the watery vapour, in the form of dew, miſt, rain, &c. Hence the uſe of the barometer, becauſe it gives warning of theſe changes in the atmoſphere, before their effects are either ſeen or felt by us. And hence we may account for an obſervation of Pliny's, that the ſpeedy drying of the ſurface of the earth is a ſign of a northerly wind and fair weather; and it's becoming moiſt, of ſoutherly wind and rain. As the atmoſphere approaches to it's greateſt height, or the quick-

ſilver riſes high in the barometer, the air takes up all the waſte water on the ſurface of the earth, and ſo dries it. Hence the farmer may be inſtructed, never to truſt a ſun-ſhining day, while the ſurface of the earth continues wet; and to rely on a change to dry weather, as ſoon as he obſerves the moiſture dried up, even though the appearance of the clouds ſhould not be favourable.

This opinion is thus confirmed in the meteorological obſervations of the Academy of Sciences for the year 1742.

Since water imbibes and abſorbs the air that touches it's ſurface, lodges it in it's interſtices, making no longer but one body together; carries it along by it's motion of fluidity to the bottom of the veſſel that contains it; and ſince air, notwithſtanding it's ſpecific gravity, which is much leſs than that of water, unites itſelf with it; it follows neceſſarily, that air may take up, abſorb, and imbibe water on which it floats, and againſt which it is continually urged by the whole weight of the atmoſphere; and that water, notwithſtanding it's greater ſpecific gravity,

may inſinuate itſelf into air, unite with it, follow all its motions, and make but an uſeleſs effort to fall back again, ſo long as it continues intimately mixed.

" The air of itſelf," ſays Dr. Halley, " imbibes a certain quantity of watery va- " pours, and retains them like ſalt diſſol- " ved in water. The air abounding with " this water, being carried againſt the upper " parts of high and cold mountains, the " particles are condenſed by the cold, and " fall to the earth, towards the north and " eaſt, during the firſt part of the night, " and towards the ſouth and weſt after mid- " night, as the air becomes colder. The " particles there uniting, are converted to a " real fluid, which glides gently down, or " entering into the caverns of the hills, is " gathered as in an alembic, deſcends into " lower places, and breaking out in the " ſides of the hills, forms ſprings.

" This theory of ſprings is not a bare hy- " potheſis, but founded on experience, " which it was my luck to gain in my abode " at St. Helena, where, in the night time,

" on the tops of the hills, about eight hun-
" dred yards above the ſea, there was ſo plen-
" tiful a precipitation of the vapours, that it
" was a great impediment to my celeſtial
" obſervations: for in the clear ſky, the
" dews fell ſo faſt, as to cover my glaſſes
" each quarter of an hour with little drops;
" ſo that I was neceſſitated to wipe them off
" ſo often: and the paper on which I wrote
" my obſervations, would be immediately
" ſo wet with dew, that it would not bear
" ink." This account demonſtrates how great a quantity of watery vapour there is in the upper regions of the air.

The vapours deſcend in the atmoſphere from various cauſes. Whatever leſſens the ſpecific gravity of the air, cauſes bodies which before were equiponderant with it, to fall lower into ſpaces where the air is of the ſame ſpecific gravity with them; or to fall out of it; as is ſeen in the receiver of an air-pump, upon drawing out ſome of the air. When vapours greatly rarified by heat, afterwards cool, and ſo become ſpecifically heavier; or when any other propelling cauſe

ceaſes, they fall lower into a denſer air. When ſeveral particles meeting together unite, whether by winds blowing from different quarters, or any other cauſe that creates an unequal motion in the air, whereby the watery particles come into more frequent contact, they become ſpecifically heavier than the air, and therefore deſcend.

Clouds are the watery vapours collected together, ſo as to intercept a good deal of light, and render the air more opake than uſual: or clouds are only fog or miſt raiſed higher in the air, and there floating about; as is experienced by travellers, who in croſſing mountains covered with ſuch clouds, never find them to be ſnow, or of any firm conſiſtence, unleſs the mountains are ſo high as to reach the frozen region of the air. Clouds generally appear to be whiter than fog, owing to the quantity of light reflected from them as far as the ſun ſhines on them. They riſe to very different heights in the atmoſphere, according to the ſpecific gravity of the watery particles of which they are compoſed.

Fog is exhalations either riſing ſlowly from the earth, or returning very ſlowly to it. When compoſed of watery vapours only, as thoſe are which ariſe at ſea, it is neither hurtful, nor ſtinks; but when of other exhalations, it often carries in them the ſeeds of many diſeaſes. Fog is moſtly ſeen in the night and morning, eſpecially if the ſun, in the day, has heated the earth much, which is again cooled after ſun-ſet. This happens chiefly in ſpring and autumn; ſeldomer in the ſummer; becauſe there is leſs difference between the heat of the day and night in the ſummer, than in ſpring and autumn. Fog ſometimes wets like ſmall rain, and then it is called *miſt*.

In the ſummer, when the weather is fair, the heat of the ſun penetrates to ſome depth into the earth, and not only water, but other volatile particles are carried up into the air, by the power of the ſolar rays, and float in it near the ſurface of the earth. As long as theſe exhaltations are kept in agitation by the heat of the ſun, ſo long nothing of them appears to the eye: but ſoon after the ſolar

heat begins to remit, the air grows cool, whilſt the earth, retaining it's heat much longer than the air, continues to breathe out exhalations: whence, in ſome places, ariſes a white viſible vapour called *dew*; though in general the vapours remain inviſible. This viſible vapour appears firſt in watery or marſhy places, whence diſperſing itſelf by degrees, it covers the face of the lower grounds with a cloud in the evening and night. In the morning, it is again diſſipated by the heat of the riſing ſun. This vapour muſt be of a very different nature in different places, according to the qualities of the various ſubſtances in the places whence it ariſes. For inſtance, in dry gravelly grounds of a large extent, the dew is entirely water, and uſually inviſible: while that which ariſes from ſtanding waters, moraſſes, bituminous earths, or places abounding with the exhalations of putrid bodies, muſt have various ſubſtances in it, and may often be pernicious to health; and yet may be loaded with many particles fit for the nouriſhment of vegetables.

An opinion long prevailed, that the dew

which is collected on various parts of plants, was the watery vapour which fell from the air. Many and accurate experiments and obſervations evince, that the dew on plants is moſt frequently the ſweat of the plants continually eſcaping through the orifices of their veſſels; each plant having a different dew, where theſe orifices are the moſt numerous and open. This moiſture exhales perpetually from plants, but is diſſipated by the winds or heat during the day.

Rain is formed, when the watery particles compoſing a cloud approach ſo near to each other, that they unite into drops, which becoming ſpecifically heavier than the air, they fall down, and in their deſcent light upon others, which increaſe their bulk to what we find them when they reach the earth. If the cauſe thus uniting them obtains equally through the cloud, and the vapours gradually unite into ſmall drops very little ſpecifically heavier than the air, they fall down in a miſling rain. This may happen when the cauſe acts firſt in the lower part of the cloud, and gradually proceeds upwards. If

the cauſe firſt takes place in the upper part of the cloud, and proceeds gradually downwards, the ſmall drops above falling down through others, unite with them; and this continually increaſing, they reach the earth in large drops. In ſuch a ſhower, a perſon aſcending a mountain, will find the drops leſſer as he aſcends. The largeſt drops of rain fall in the ſummer, owing to the vapours being raiſed higher in the atmoſphere at that time by the heat of the ſun; whereas the force of the winter's ſun raiſing the watery vapour to a leſs height, the rain falls then in ſmall but numerous drops.

If watery exhalations meet with no cauſe to condenſe or diſſipate them, they ſometimes form a thick heavy dry air, which often laſts for ſeveral days, without either ſun or rain. "In this caſe," ſays Dr. Der-
"ham, "I have ſcarce ever known it to
"rain, till it has been firſt fair, or till the
"ſun has ſhone out. When this happens,
"the wind is generally in the eaſterly points;
"though I have known the ſame to happen
"be the wind where it will. I have per-

" ceived ſome ſmall drops of rain, hail, and " ſnow now and then fallling, before any " alteration hath happened in the weather."

The higher the watery vapour is raiſed in the air, the more it's particles are diſperſed in wider ſpaces; and they at the ſame time grow colder: for we conſtantly find that the heat leſſens as we approach the ſummits of the higheſt mountains, where, even under the equator, a freezing cold preſerves perpetual ſnow. There is therefore an orbit in the atmoſphere concentrical with the earth, in which the water in the air is always frozen, if it's particles are united together. The height of this orbit varies in the higher latitudes, according to the ſeaſon of the year, or warmth of the weather; as may be plainly diſcerned in mountainous countries, where the froſt and ſnow deſcend gradually on the mountains, as the winter approaches. Hence the air and guſts of hurricanes are cold, though in hot countries and ſeaſons, becauſe they come from above. When water aſcends to this orbit, it muſt neceſſarily be congealed into *ice*, unleſs it's particles

or elements are ſo far ſeparated, that they do not touch one another. As ſoon as, from any cauſe, theſe particles deſcend, or come into contact, they form icy concretions, which float in the air, or falling on the ſurface of bodies they meet with, produce a fine *hoar froſt:* or they may be collected in ſuch quantities as to form *clouds*, or fall down in *ſnow*.

In the ſummer, and in warm climates, when the watery particles in this orbit, by their union, become heavier than the air is in the ſpaces they float in, they muſt fall downward into ſpaces more replete with vapour, where they unite with other particles, and ſo gradually form larger concretions, which put on the appearance of *ſnow* or *hail*. As they begin to unite, there will appear little clouds in the air, which falling downward with a conſiderable velocity, increaſe very faſt in their magnitude, by condenſing more vapour, till a violent ſtorm enſues. It is probable that the hail, which is always formed in the upper and cold regions of the air, as it deſcends by it's weight

into thoſe that are lower and warmer, is there diſſolved by the heat, and produces thoſe great ſhowers of rain which accompany thunder and lightening. If the hail is carried ſo ſwiftly through the air, that, by reaſon of it's quick deſcent, it cannot be melted, it falls to the earth in icy concretions, which, by their ſize, weight, and motion, often do great damage. Hail-ſtones are ſeldom round or ſmooth, owing to the unequal acceſſion of matter as they fall; and from their ſtriking againſt one another, a noiſe is heard in the air.

Thunder and *lightening* have been variouſly accounted for in different ages. Since the invention of gunpowder, they have been generally aſcribed to a mixture of nitrous and ſulphureous vapours by ſome means ſet on fire in the air, and exploding like that powder: but though there is indeed ſomething ſimilar in the flaſh and noiſe, the other effects of lightening did not ſeem ſatisfactorily accounted for by ſuch a cauſe.

Modern diſcoveries in electricity, and particularly thoſe of that moſt ſkilful naturaliſt,

Dr. Benj. Franklin, whoſe ſoaring genius has realized the fable of Prometheus's bringing fire down from heaven, have furniſhed us with a better theory, now demonſtrated by experiments to be the true one. For the electricians obſerving, that the appearances and effects of the electric fluid agreed with thoſe of lightening in many particulars; *viz.* 1, in a ſudden light given; 2, in the colour of the light; 3, in the crooked direction of the flame paſſing through the air; 4, in ſwiftneſs of motion; 5, in exploding with a noiſe or crack; 6, in being capable of ſubſiſting in water or ice, and the lightening often proceeding out of clouds with rain and hail; 7, in rending ſome bodies; 8, in deſtroying animals; 9, in melting of metals; 10, in firing inflammable ſubſtances; and 11, in affording a ſulphureous ſmell; they ſuſpected the matter of lightening and the electric fluid to be the ſame: and as the electric fluid was found to be eaſily attracted by ſharp metalline points, an experiment was propoſed, to try if by erecting ſuch points on high buildings, any electricity

could be obtained by drawing ſome of that fluid from the clouds. The experiment was made, and ſucceeded. The electric fluid drawn from the clouds, is found to have all the properties of that produced by the electric machine, and no other. Light bodies are attracted and repelled by it; bottles are charged (as the electricians ſpeak) and perſons are ſhocked with it; in ſhort, it is demonſtrated to be ſpecifically the ſame. And it being among the known properties of the electric fluid, that it is eaſily conducted by any metal, and conveyed by metal rods or wires in any direction; and that it will leave other ſubſtances to paſs in metal, and do them no damage ſo far as it can have metal to paſs in; an uſeful inference has hence been drawn, *viz.* that buildings may be preſerved from the ſtroke of lightening, by fixing pointed iron rods to the higheſt parts, with wires from ſuch rods down to the ground, to receive and conduct the lightening to the earth.

Tall trees, and lofty buildings, as the towers and ſpires of churches, become ſome-

times conductors between the clouds and the earth; but not being good ones, that is, not conveying the fluid freely, they are often damaged.

Buildings which have their roofs covered with lead, or other metal, and ſpouts of metal continued from the roof into the ground to carry off the water, are never hurt by lightening, and whenever it falls on ſuch a building, it paſſes in the metals and not in the walls.

When other buildings happen to be within the ſtriking diſtance from ſuch clouds, the fluid paſſes in the walls whether of wood, brick, or ſtone, quitting the walls only when it can find better conductors near them, as metal rods, bolts, and hinges of windows or doors, gilding on wainſcot, or frames of pictures; the ſilvering on the backs of looking-glaſſes; the wires of bells; and the bodies of animals, as containing watery fluids. And in paſſing through the houſe it follows the direction of theſe conductors, taking as many in it's way as can aſſiſt in it's paſſage, whether in a ſtrait or crooked line,

leaping from one to the other, if not far diſtant from each other, only rending the wall in the ſpaces where theſe partial good conductors are too diſtant from each other.

An iron rod being placed on the outſide of a building, and continued from the higheſt part down into the moiſt earth, in any direction ſtrait or crooked, following the form of the roof or other parts of the building, will receive the lightening at it's upper end, attracting it ſo as to prevent it's ſtriking any other part; and, affording it a good conveyance into the earth, will prevent it's damaging any part of the building.

A ſmall quantity of metal is found able to conduct a great quantity of this fluid. A wire no bigger than a gooſe quill, has been known to conduct (with ſafety to the building as far as the wire was continued) a quantity of lightening that did prodigious damage both above and below it; and probably larger rods are not neceſſary, though it is common in America to make them of half an inch, ſome of three quarters, or an inch diameter.

The rod may be faſtened to the wall,

chimney, &c. with ſtaples of iron.—The lightening will not leave the rod (a good conductor), to paſs into the wall (a bad conductor), through thoſe ſtaples.—It would rather, if any where in the wall, paſs out of it into the rod, to get more readily by that conductor into the earth.

If the building be very large and extenſive, two or more rods may be placed at different parts, for greater ſecurity.

Small ragged parts of clouds ſuſpended in the air between the great body of clouds and the earth (like leaf gold in electrical experiments), often ſerve as partial conductors for the lightening, which proceeds from one of them to another, and by their help comes within the ſtriking diſtance to the earth or a building. It therefore ſtrikes, through thoſe conductors, a building that would otherwiſe be out of the ſtriking diſtance.

Long ſharp points communicating with the earth, and preſented to ſuch parts of clouds, drawing ſilently from them the fluid they are charged with, they are then attracted to the cloud, and may leave the

diſtance ſo great as to be beyond the reach of ſtriking.

It is therefore that expert electricians elevate the upper end of the rod ſix or eight feet above the higheſt part of the building, tapering it gradually to a fine ſharp point, which is gilt to prevent it's ruſting.

Thus the pointed rod either prevents a ſtroke from the cloud, or, if a ſtroke is made, conducts it to the earth with ſafety to the building.

The lower end of the rod ſhould enter the earth ſo deep as to come at the moiſt part, perhaps two or three feet; and if bent when under the ſurface, ſo as to go in a horizontal line ſix or eight feet from the wall, and then bent again downwards three or four feet, it will prevent damage to any of the ſtones of the foundation; eſpecially if it can be made to terminate in a place where there is water.

This has been practiſed for ſome years paſt in ſeveral of our American colonies, where thunder ſtorms are moſt frequent; and no houſe ſo guarded has ever been damaged by lightening.

A perſon apprehenſive of danger from

lightening, happening during the time of thunder to be in a houſe not ſo ſecured, will do well to avoid ſitting near the chimney, near a looking glaſs, or any gilt pictures or wainſcot; the ſafeſt place is in the middle of the room, (ſo it be not under a metal luſtre ſuſpended by a chain,) ſitting in one chair and laying the feet up in another. It is ſtill ſafer to bring two or three mattraſſes or beds into the middle of the room, and folding them up double, place the chair upon them; for they not being ſo good conductors as the walls, the lightening will not chuſe an interrupted courſe through the air of the room and the bedding, when it can go through a continued better conductor, the wall. But where it can be had, a hammock or ſwinging bed, ſuſpended by ſilk cords equally diſtant from the walls on every ſide, and from the cieling and floor above and below, affords the ſafeſt ſituation a perſon can have in any room whatever; and what indeed may be deemed quite free from danger of any ſtroke by lightening.

Whoever would be more fully inſtructed

in theſe intereſting points, will naturally, and very rightly, conſult what Dr. Franklin himſelf has ſaid in his *Philoſophical Letters**, and particularly the LIXth.

* Subjoined to his *Experiments on Electricity*, printed in 1769.

SECTION II.

Prognoſtics of the Weather taken from Vegetables and Animals.

IT appears from numbers of inſtances, that the changes of the weather have very ſenſible effects on many animals and vegetables, and eſpecially on the flowers of the latter, which open and expand their leaves as if to welcome the fair weather, and ſhut them to guard the tender fruit from the impending ſtorms. This is remarkably apparent in the flowers of *pimpernel* (burnet), which Gerard, for that reaſon, terms the countryman's weather-glaſs; in the down of *dandelion* and other downs; and in the ſwelling and conſequent erectneſs of the ſtalks of *trefoil*, againſt rain.

We do not know that animals have any powers fitting them for this quick ſenſe more than men have; except that their fluids and veſſels being conſtantly in a more equal ſtate, owing to their uniform way of living, cauſes from without have a proportionally greater, or at leaſt more ſenſible effect upon them, than on us, whoſe irregularities and inattention render many things imperceptible to us, which the brute creation are manifeſtly affected by. Virgil's beautiful deſcription of of this ſenſe in animals, is thus rendered by Mr. Dryden:

Wet weather ſeldom hurts the moſt unwiſe;
So plain the ſigns, ſuch prophets are the ſkies:
The wary *crane* forſees it firſt, and ſails
Above the ſtorm, and leaves the hollow vales:
The *cow* looks up, and from afar can find
The change of heav'n, and ſnuffs it in the wind.
The *ſwallow* ſkims the river's wat'ry face,
The *frogs* renew the croaks of their loquacious race.
The careful *ant* her ſecret cell forſakes,
And drags her eggs along the narrow tracks.
Huge flocks of riſing *rooks* forſake their food,
And, crying, ſeek the ſhelter of the wood.

Beſides, the ſev'ral ſorts of *wat'ry fowls*,
That ſwim the ſeas or haunt the ſtanding pools,
Then lave their backs with ſprinkling dews in vain,
And ſtem the ſtream to meet the promis'd *rain*.
The *crow*, with clam'rous cries the *ſhow'r* demands,
And ſingle ſtalks along the deſart ſands.

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Then, after ſhow'rs, 'tis eaſy to deſcry
Returning ſuns, and a *ſerener* ſky.

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Their litter is not toſs'd by *ſows* unclean,

— — — — — — — — — —

And *owls*, that mark the ſetting ſun, declare
A ſtar-light ev'ning, and a morning *fair*.

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Then, thrice the *ravens* rend the liquid air,
And croaking notes proclaim the *ſettled fair*:
Then round their airy palaces they fly
To greet the ſun; and ſeiz'd with ſecret joy
When ſtorms are over blown, with food repair
To their forſaken neſts and callow care.

GEORG. I.

Likewiſe, againſt *rain*, numbers of *earth-worms* will creep out of the ground, *moles* caſt up more earth than uſual, *fleas* bite more than common, *ſpiders* crawl more

abroad, *flies* become uncommonly troubleſome, and *bees* ſtir not far from their hives. On the contrary, *ſpiders webs* in the air, or on the graſs or trees, foretell very *fair* and *hot* weather: ſo do *bees*, when they fly far from their hives, and come late home; and likewiſe a more than uſual appearance of *glow worms* by night. *Gnats* too are ſaid to foretell the weather, in that, if they play up and down in the open air near ſun-ſet, they preſage *heat*; if in the ſhade, warm and mild *ſhowers*; but if they join in ſtinging thoſe that paſs by them, *cold* weather and much *rain* may be expected.

Again; *larks* riſing very high and continuing to ſing for a long time, and *kites* flying aloft, are ſigns of *fair* and *dry* weather.

In *men*; frequently, aches, wounds, and corns are more troubleſome, either towards *rain*, or towards *froſt*.

SECT.

SECTION III.

Prognoſtics of the Weather, taken from the Sun, Moon, and Stars.

I NOW proceed to the ſhepherd of Banbury, whoſe rules to judge of the weather I ſhall give, and at the ſame time examine how far they are confirmed by reaſon and other authorities.

1*ſt Rule.* If the ſun riſe red and firey—*Wind and Rain.*

2*d Rule.* If cloudy, and the clouds ſoon decreaſe—*Certain fair weather.*

The ſhepherd begins with obſervations ariſing from the different appearances of the ſun. Theſe rules may be extended to all the heavenly bodies: for as their rays paſs through the atmoſphere, the vapours in the air have the ſame effect on each.

The *rain-bow* ſhews us that the rays of light admit of different degrees of refraction, and that according to thoſe different degrees of refraction, they appear of different colours. A clear unclouded ſky teaches us,

that while the vapours are equally diſperſed in the atmoſphere, the rays reach us without undergoing a change, or variety of colours. It is known to thoſe converſant in experimental philoſophy, that this refraction of the rays of light ariſes from a difference in the denſity of the medium through which the rays paſs. It ſeems probable, that while the watery vapour in the air is divided into it's minuteſt particles, it perhaps only reflects the rays of light, but does not refract them till collected into the form of water, as into clouds, rain, &c. When the farmer therefore ſees the ſun or moon riſe or ſet red and firey, or ſees the clouds and horizon of that colour, he may expect wind and rain, owing to the unequal diſtribution of the vapours, or to their being already collected into watery globules by ſome preceding cauſe. Thus Virgil;

Obſerve the daily circle of the *ſun*,
And the ſhort year of each revolving *moon*:
By them thou ſhalt foreſee the following day;
Nor ſhall a ſtarry night thy hopes betray.
When firſt the *moon* appears, if then ſhe ſhrouds
Her ſilver creſcent, tipp'd with ſable clouds;

Conclude ſhe bodes a tempeſt on the main,
And brews for fields impetuous floods of *rain*.
Or if her face with firey flufhings glow,
Expect the ratling *winds* aloft to blow.
But *four* nights old, (for that's the fureſt ſign)
With ſharpen'd horns if glorious then ſhe ſhine;
Next day, nor only that, but all the moon,
Till her revolving race be wholly run,
Are void of tempeſts both by land and ſea.

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Above the reſt, the *ſun*, who never lyes;
Foretells the change of weather in the ſkies:
For if he riſe unwilling to his race,
Clouds on his brow, and ſpots upon his face;
Or if through miſts he ſhoots his ſullen beams,
Frugal of light, in looſe and ſtraggling ſtreams;
Suſpect a *driſling* day with ſouthern *rain*.

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Or if *Aurora*, with half open'd eyes,
And a pale ſickly cheek ſalutes the ſkies;
How ſhall the vine, with tender leaves defend
Her teeming cluſters, when the *ſtorms* deſcend?

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But more than all, the *ſetting ſun* ſurvey,
When down the ſteep of heav'n he drives the day:
For oft we find him finiſhing his race,
With various colours erring on his face.

In firey *red* his glowing globe deſcends,
High *winds* and furious *tempeſts* he portends:
But if his cheeks are ſwoln with livid *blue*,
He bodes *wet* weather by his wat'ry hue:
If *duſky* ſpots are vary'd on his brow,
And ſtreak'd with *red*, a troubled colour ſhow;
That ſullen mixture ſhall at once declare
Winds, *rain*, and *ſtorms*, and elemental war.

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But if with *purple* rays he brings the light,
And a pure heav'n reſigns to quiet night;
No riſing *winds*, or falling *ſtorms* are nigh.

The *circle* which frequently appears about the *moon*, and ſometimes about the *ſun*, as alſo the *mock-ſuns* and *moons*, proceeding from the great quantity of watery vapour loading the lower air, likewiſe preſage *rain* or *wind*, and often both.

If, according to the *ſecond* rule, the ſun riſes *cloudy*, and the clouds ſoon decreaſe, the vapours are more equally diſtributed in the atmoſphere; which equal diſtribution is alſo promoted by the warmth of the riſing ſun. Hence we may account for an obſervation adopted into all languages,

The evening red, *and the morning* grey,
is a ſign of a fair *day.*

For if the abundance of vapour denoted by the *red* evening ſky falls down in dew, or is otherwiſe ſo equally diſperſed in the air, that the morning ſhall appear *grey*, we may promiſe ourſelves a *fair* day, from that equal ſtate of the atmoſphere.

If, in the morning, ſome parts of the ſky appear *green* between the clouds, while the ſky is *blue* above, *ſtormy* weather is at hand.

The great lord Bacon gives us the following rules to judge of the enſuing weather from the firſt appearance of the *moon*, and it is ſaid that theſe obſervations of his have never been known to fail.

1*ſt.* If the *new moon* does not appear till the *fourth* day, it prognoſticates a *troubled air* for the whole month.

2*d*, If the *moon*, either at her firſt appearance, or within a few days after, has her *lower* horn obſcured or duſky, or any ways ſullied, it denotes *foul weather* before the full; but if ſhe be diſcoloured in the *middle*,

ſtorms are to be expected about the full, or about the wane if her *upper* horn is affected in like manner.

3*d*. When the moon, on her *fourth* day, appears pure and ſpotleſs, her horns unblunted, and neither flat nor quite erect, but betwixt both, it promiſes *fair weather* for the greateſt part of the month.

4*th*. An *erect moon* is generally *threatning and unfavourable*, but particularly denotes *wind*; though if ſhe appear with ſhort and blunted horns, *rain* is rather expected.

SECTION IV.

Prognoſtics of the Weather taken from the Clouds.

THE ſhepherd's 3*d rule*. Clouds ſmall and round, like a dappled grey, with a north wind, portend *fair weather for two or three days*.

4th *Rule*. Clouds large like rocks,—*great ſhowers*.

5th *Rule*. If ſmall clouds increaſe,—*much rain*.

6th *Rule.* If large clouds decreaſe,—*fair weather.*

7th *Rule.* In ſummer or harveſt, when the wind has been ſouth two or three days, and it grows very hot, and you ſee clouds riſe with great white tops like towers, as if one were on the top of another, and joined together with black on the neither ſide, *there will be thunder and rain ſuddenly.*

8th *Rule.* If two ſuch clouds ariſe, one on either hand, *it is time to make haſte to ſhelter.*

The third rule ſeems contrary to an obſervation mentioned by Mr. Worlidge, viz. that "in a fair day, if the ſky ſeem to be dappled with white clouds, (which they uſually term a mackarel ſky,) it generally predicts *rain.*" This is confirmed by a very ingenious gentleman, who has conſtantly obſerved, that "in dry weather, ſo ſoon as clouds appear at a great height ſtriped like the feathers in the breaſt of a hawk, *rain* may be expected in a day or ſo."

Mr. Worlidge proceeds thus. "In a clear evening, certain ſmall black clouds appear-

ing, are undoubted ſigns of *rain* to follow; or if black or blue clouds appear near the ſun at any time of the day, or near the moon by night, *rain* uſually follows.

" If ſmall wateriſh clouds appear on the tops of hills, *rain* follows; as they obſerve in Cornwall, that

" *When Hengſton is wrapped with a cloud, a ſhower follows ſoon after.*

" The like they obſerve of Roſemary-topping, in Yorkſhire, and many other places in England.

" If clouds grow or appear ſuddenly, the air otherwiſe free from clouds, it ſignifies *tempeſts* at hand, eſpecially if they appear to the ſouth or weſt."

If many clouds, like fleeces of wool, are ſcattered from the eaſt, they foretel *rain* within three days.

When clouds ſettle upon the tops of mountains, they indicate *hard* weather.

When the tops of mountains are clear, it is a ſign of *fair* weather.

The account before given of the nature and cauſe of clouds, explains ſufficiently theſe

rules of the ſhepherd and Mr. Worlidge. As an illuſtration of the ſeventh and eighth rules, I ſhall give the following ſuppoſition from Boerhaave's chemiſtry.

"If a large white, what may be ſuppoſed a frozen cloud, be oppoſed to the ſun, the rays reflected by the ſide next the ſun muſt rarefy or heat the air betwixt it and the ſun, while at the ſame time, allowing that the cloud is not tranſparent, the cold will be great in the part turned from the ſun, and the air ſo much the denſer: whence muſt ariſe a violent motion of the cloud. which will be the more rapid, the greater the ſun's heat is on one ſide, and the keener the cold is on the other ſide. If a few ſuch clouds are ſo diſpoſed, that their joint effects meet in one place, which may often be the caſe, it is eaſy to conceive that a very great heat muſt ſuddenly ariſe in ſuch a place, and the air be as greatly expanded therein. On a change of the ſituation of the clouds, and a conſequent diſſipation of the rays of the ſun, the heat ceaſes, and the cold air, ſnow, hail, rain, or other ſubſtances near at hand, will

ruſh violently into the ſpaces ſo heated; whence moſt ſtupendous and deſtructive effects may be produced. Hence it will not be ſurpriſing, that a ſmall cloud appearing in a clear ſky, in a hot climate, ſtill increaſing till it reaches the earth, produces thoſe direful effects travellers acquaint us they meet with in certain latitudes: and thus, even in our northern climate, ſmall white clouds are ſometimes ſeen at a good height, eſpecially after a drought or calm, continually increaſing, and as they increaſe, turning leſs and leſs white, till at length they burſt down in heavy ſhowers, which falling in large drops, ſhew that they come from a conſiderable height, and that they had probably been hail. As the air admits of greater rarefaction than water, the watery vapour muſt conſequently precipitate out of the heated rarefied air. From this cauſe the inequality of rain in ſuch ſhowers may proceed."

SECT.

SECTION V.

Prognoſtics of the Weather taken from Miſt.

NINTH *Rule.* If miſt riſes in low grounds and ſoon vaniſhes,—*fair weather.*

10th *Rule.* If it riſes up to the hill tops,—*rain in a day or two.*

11th *Rule.* A general miſt before the ſun riſes, near the full moon,—*fair weather.*

12th *Rule.* A general miſt before the ſun riſes, if in the new moon,—*rain in the old.*

13th *Rule.* A general miſt before ſun riſes, if in the old moon,—*rain in the new.*

Upon a careful peruſal of a regiſter of the weather, kept near Oundle in Northamptonſhire for ſeveral years, and which will be inſerted in theſe ſheets, I do not find that the twelfth and thirteenth rules hold ſo univerſally true, as to be eſtabliſhed rules to judge of the weather. Though this regiſter bears the marks of judgment and great accuracy, and it's having been ſent to the Royal Society gives it a

ſufficient ſanction for truth; and though theſe rules appear to me in this light, yet the fact may be as mentioned by the ſhepherd.

It might be expected, that as the joint attractions of the ſun and moon have ſo apparent and great effects on the tide, the ſame influence would be manifeſt on our atmoſphere and it's contents. Thus, if the atmoſphere is loaded with watery vapours in the ſecond and fourth quarters of the moon, it would ſeem probable, that as their joint attractions daily coincide more and more till the new and full moon, ſo long the vapours would be ſuſpended; but that, as after the change, or full moon, their joint attractions leſſen every day till the firſt and third quarter, theſe vapours would fall down in rain in thoſe quarters of the moon. This opinion, of the weather's being influenced by the age of the moon, is of very long ſtanding; and perhaps in countries where the cauſes of the changes of the weather act more uniformly, the caſe may be ſo. As far as I can judge from the above-mentioned regiſter, the changes of the weather ſeem to be influenced

more by the moon's place in the ecliptic, than by her age: yet this is not ſo conſtant as to make it an eſtabliſhed rule. The influence which the moon is obſerved to have on the tide, would naturally lead men to expect her having the ſame influence on the weather: and when an opinion once obtains, that a change of the weather happens at certain times, the change is expected; and as often as it takes place, the remembrance of it remains; but we ſoon forget the number of times it fails, unleſs the mind is aſſiſted by a faithful journal of the weather.

While ſpeaking of miſts, I think I ought not to omit the following obſervation, recorded in the memoirs, &c. of the Berne Society, for the year 1763.

In large foreſts, where the ſun never penetrates, there reigns a conſtant cold; and that it is which renders the air of Swiſſerland, for example, particularly ſharp, and frequently occaſions thoſe heavy ſhowers of hail, and other ſtorms, which the inhabitants of that country ſo often experience. Thus, as is remarked by one of their ingenious writers,

in the weſt part of the Pays de Vaud, when they ſee in the morning a ſmall cloud ariſe over the woods, even in fine calm weather, when no other cloud appears, it ſeldom happens but that a ſtorm falls in the evening. They obſerve, that when a miſt ariſes over a certain very cold fountain in the foreſt of Gibloux, there will certainly be a ſtorm on the ſame day.

SECTION VI.

Prognoſtics of the Weather taken from Rain.

FOURTEENTH *Rule.* Sudden rains *never laſt long:* but when the air grows thick by degrees, and the ſun, moon, and ſtars ſhine dimmer and dimmer, *it is likely to rain ſix hours uſually.*

15th *Rule.* If it begins to rain from the ſouth, with a high wind, for two or three hours, and the wind falls, but the rain continues, *it is likely to rain twelve hours or more; and does uſually rain till a ſtrong north wind clears the air.* Theſe long rains ſeldom *hold*

above twelve hours, or happen *above once a year.*

16th *Rule.* If it begins to rain an hour or two before ſun-riſing, *it is likely to be fair before noon, and to continue ſo that day:* but if the rain begins an hour or two after ſun-riſing, *it is likely to rain all that day, except the rainbow be ſeen before it rains.*

A ſudden rarefaction of the lower air, or perhaps more frequently a cold cloud deſcending from above, or cold wind deſcending from above and condenſing the inviſible vapours ſo as to form a cloud, are the moſt frequent cauſes of ſudden rain. The rain therefore ceaſes as ſoon as an equal temperature is reſtored to the atmoſphere: but if the vapours are collected in the manner deſcribed in the latter part of the *fourteenth* rule, it is no wonder that the rain continues longer.

In the ſtate of the air deſcribed in the *fifteenth* rule, the mercury in the barometer will always be found low, which indicates that the atmoſphere is light. The rain therefore continues to fall, till a cooler and denſer

air from the north enables the atmoſphere to ſupport the vapours.

The duration of the rain in an inland country, like Oxfordſhire, where the ſhepherd lived, may not exceed *twelve hours*; but I doubt this will not hold as a general rule either of it's duration or frequency in all places; for near the ſea, rains happen often which laſt a whole day.

Mr. Worlidge mentions the following ſigns of *rain.*

" The audibility of ſounds are certain prognoſtics of the temper of the air in a ſtill evening: for if the air be replete with moiſture over us, it depreſſeth ſounds, ſo that they become audible to a greater diſtance than when the air is free from ſuch moiſture or vapours. From whence you may conclude, that in ſuch nights or other times that you hear ſounds of bells, noiſe of water, beaſts, birds, or any other ſounds or noiſes more plainly than at other times, the air is inclinable to rain, which commonly ſucceeds.

" I have often obſerved that the ſinking

of rivers more than uſual at ſuch ſeaſons of the year, hath been a certain preſage of much *rain* to follow; and that the continuing fall of rivers after rain, hath been a ſure preſage of *dry* weather.

" If the earth, or any moiſt or fenny places yield any extraordinary ſcents or ſmells, it preſageth *rain*.

" If dews lie long in the morning on the graſs, &c. it ſignifies *fair* weather: but if they riſe or vaniſh ſuddenly and early in the morning, it preſageth *rain*.

" There is a ſmall bird, of the ſize and near the ſhape of a marten, that at ſome times flies very near the water, which is a moſt ſure prognoſtic of *tempeſtous* weather; never appearing but againſt ſuch weather, as hath been conſtantly obſerved by the boatmen in the Severn, and channel between the Iſle of Wight and the main land.

" Ducks and geeſe picking their wings, waſhing themſelves much, or cackling much, ſignifies *rain*.

" If after rain comes a cold wind, it ſignifies more *rain*.

" The nightly virgin, whilſt her wheel ſhe plies,
Foreſees the *ſtorm* impending in the ſkies,
When ſparkling lamps their ſputt'ring light advance,
And in their ſockets oily bubbles dance.

SECTION VII.

Prognoſtics of the Weather taken from the Winds.

WHEN the atmoſphere is of the ſame weight and denſity over a conſiderable extent of the ſurface of the earth, there a calm will obtain: but if this equipoiſe is taken off, a ſtream of air, or wind, is thereby produced, ſtronger or weaker in proportion to the alteration made in the ſtate of the atmoſphere. There are divers cauſes which make theſe alterations in the equipoiſe of the atmoſphere; ſuch as rarefactions or condenſations in one part more than in another; vapours riſing from the earth or ſea, preſſure of the clouds, &c. I ſhall not attempt here to enter into a diſquiſition concerning the cauſes of winds in general, but refer the curious to lord Bacon, Mr. Bohun, Dr.

Halley, Dr. Franklin, and others who have written more fully on this ſubject, and confine myſelf chiefly to the winds ſo far as relates to this iſland.

We may aſſign three cauſes of our ſtated winds in this iſland. The firſt of theſe ſtated winds is the *weſterly*, which ſo frequently obtains every where beyond the limits of the trade wind, and has been moſt judiciouſly accounted for by Dr. Franklin, in his philoſophical works (*p.* 188, *et ſeq*). This general weſterly wind is found to blow moſtly from the north-weſt in the Ocean, and where other cauſes do not intervene. Lord Bacon mentions the other two cauſes, as having been long obſerved, *viz.* that winds blow moſt frequently from the ſea; and next, that where there are high mountains covered with ſnow, ſtated winds blow from that quarter at the time the ſnow diſſolves.

Lord Bacon imputes the frequency of the winds from the ſea, to the copious aſcent of watery vapour from it; and as ſigns that ſuch vapours do aſcend from it, he obſerves, that " the ſea and lakes ſometimes ſwell

very conſiderably, though no winds are found to blow, which," ſays he, "it is probable is occaſioned by the warm vapour riſing out of the earth under the water. At ſuch times a kind of murmuring noiſe is heard, the ſounding of the ſhore is heard to a greater diſtance than uſual, and ſometimes a froth or watery bubbles are ſeen on the ſea, whilſt it is flat and calm. Hence miners foretel ſtorms, by the muddineſs of the water, or by the fumes which riſe in mines, before any ſigns appear above ground." Mr. Bohun relates, that, in Cornwall, they have ſo ſure prognoſtics of ſtorms at ſea, from their mines, that the fiſhermen never preſume to tarry out, when the ſignal is given by the eruption of certain meteors, which immediately preſage a tempeſt. In St. Owen's bay, in the iſle of Jerſey," continues he, "the ſea is often ſtrangely diſturbed before the weſtern ſtorms, even when the air is very calm; and though no wind be ſtirring, yet the roaring of the waves may be heard, not only over the whole iſle, but into France,

about thirty miles diſtant, which is the certain prognoſtic of an enſuing tempeſt."

This agitation of the ſea, and noiſe of the water, may be occaſioned by a ſtorm in the Atlantic Ocean, with the wind at weſt; for as the ſtorm proceeds eaſtward, the waves raiſed by it will greatly out-go the wind, and thereby reach the eaſtern coaſt ſome hours before the wind arrives there. It is probable, that if any ſtorms ariſe from vapours aſcending thus from the earth under the ſea, they are only ſuch as are very violent: for that power which the air has of taking up water, will ſupply ſufficient to occaſion the winds ſo frequent from the ſea, and is perhaps their moſt general cauſe.

Wind, as the reverend and ingenious Mr. Borlace very properly remarks*, is air in motion, excited by various cauſes. The ſun, by concurrent circumſtances in land, water, and vapour, lightens and diſperſes the air from one place, and at one time, more than at another. Inflammable exhalations, and

* In his excellent Natural Hiſtory of Cornwall, p. 8.

other exploſions ſhall warm and thin the air in particular places. A cloud or portion of vapour full of electrical matter, paſſing over a cloud or region of land more deſtitute of electrical matter, will ſhed ſtreams of fire upon the leſs electric body, and thereby excite violent motions, &c. Now, wherever the air is thrown into a ſtate of rarefaction, there a vacuity is produced, and the adjacent air flows as water to the breach of a dam, and the flood is either violent or not, as the ſpace through which it paſſes is ſhaped; laſting as the quantity of fluid ſet in motion, and as the extent of the vacuity is to be repleniſhed. If the vacuity be ſpacious, the flow will be plentiful (obſtructions in the way being allowed for); if the channel through which the influx runs be long, narrow, and funnel-like, the velocity will be great, and *vice verſa*; but if a large quantity of condenſed air chances at this time to preſs forward towards this large vacuity, the motion of the air will be impetuous, or what we call a *ſtorm*. If, on the other hand, the rarefactions in particular diſtricts be gentle,

and there is room for denſer air to ſucceed without violence, the motion alſo is gentle; and where no extraordinary rarefactions are produced, and the vapours are equally diſperſed, a calm enſues.

If rarefying vapours aſſume the ſhape of an oblate diſk, over-ſpreading as a canopy a wide extent, the weight and continuity of the incumbent air is in this diſtrict, for a time, and to a certain degree, ſuſpended; the mercury ſinks in the barometer, and at the ſame time the current of the air above this diſk ſhall go one way, towards any vacuity which ſhall create a freſh tendency, and the under current of air, influenced by another rarefaction, ſhall go in a different, perhaps oppoſite direction; there being no communication between the currents above and below the diſk of vapours, ſufficient to determine them to one point. Thus again, by the fall or even receſs of a great body of vapours in one place out of our ſight, the air over our heads before condenſed, and keeping the mercury high, extends itſelf into the vacuity, the wind blows, and the mercury falls

in a ſerene ſky, to our ſurprize. By the riſing of a like body of vapours, and accumulating the air of our horizon, the mercury riſes in a cloudy and even rainy ſky. When the wind is violent, the perpendicular preſſure of the air is much leſſened by the velocity of the horizontal motion, and the mercury falls. When the air is fulleſt of vapours, the mercury falls; the preſſure of the atmoſphere depending not only on the weight of the fluid, but alſo on the agility and elaſticity of the column of air which is broken and interrupted by ſuch a quantity of moiſture floating between, condenſing, and ready to fall. Theſe and many other variations which might be mentioned, are the neceſſary reſults of meteors, vapours, and air intermixed in ſeparate portions, and acting with reciprocal, but, generally, very different powers.

The moſt common and the moſt violent winds in France come almoſt always from the ſouth-weſt, and they very often bring rain; becauſe there riſe more vapours from the ſea to load theſe winds, than thoſe which

blow from the eaſt: and it has been obſerved that clouds never fail to increaſe the force of the wind. The reaſon may be this, that the wind, though in itſelf moderate, being confined between the clouds and the earth, it's violence muſt in conſequence be augmented.

It has frequently been remarked, that the winds in the upper region of the air, as may be ſeen by the motion of the clouds, are very different from thoſe near the ſurface of the earth*.

A ſign of a change of weather which ſeemed new and ſingular to Mr. Borlace†, was thus, Auguſt 15, 1752, the wind at weſt-north-weſt, the ſky cloudy, the mercury moving upward in the barometer, at about ſix in the evening, there appeared in the north-eaſt the fruſtrum of a rain-bow. All the colours were lively and diſtinct. They call it in Cornwall a weather-dog, or weather's-eye, and pronounce it a certain ſign of hard rain. The mercury fell $\frac{1}{10}$, and that without rain. The next morning was dry, but

* *Memoirs de l'Academie Royale des Sciences, pour l'an* 1717.
† Natural Hiſtory of Cornwall, p. 17.

not clear: at about eleven it began to rain gently, and at one a flood of rain came on, which continued all night and till the next morning.

Virgil deſcribes thus the ſigns of an approaching *tempeſt*:

For ere the riſing winds begin to roar,
The working ſea advances to the ſhore;
Soft whiſpers run along the leafy woods,
And mountains whiſtle to the murm'ring floods;
And chaff with eddy winds is whirl'd around,
And dancing leaves are lifted from the ground,
And floating feathers on the waters play.

Our *northerly* winds in the beginning of the winter may ariſe from the weight of the cold northern air overcoming the warmer ſouthern air, which, as the heat leſſens, is leſs loaded with vapours, and therefore more eaſily gives way to the cold northern and denſer air. Hence the frequency of north-weſt winds at that ſeaſon.

The moſt general cauſe of the *eaſterly* winds in the ſpring and beginning of ſummer, ariſes from the melting of the ſnow on the continent, as obſerved by lord Bacon. The

warmth which conſtantly obtains in a thaw, raiſes not only much of the melting ſnow in the air, but the exhalations which had been ſo long confined by the froſt, riſe copiouſly into the air, and become the cauſe of our eaſterly winds, which are obſerved to blow more or leſs in proportion to the duration and ſeverity of the winter on the continent.

" Seas, lakes, and great bodies of water, agitated by the winds, continually change their ſurfaces, as is juſtly remarked by Dr. B. Franklin*; the cold ſurface in winter is turned under, by the rolling of the waves, and a warmer turned up; in ſummer, the warm is turned under, and colder turned up. Hence the more equal temper of ſea-water, and of the air over it. Hence in winter, winds from the ſea ſeem warm, winds from the land cold. In ſummer the contrary.

" Therefore it is that the lakes weſt of Penſylvania, as they are not ſo much frozen nor ſo apt to freeze as the earth, rather mo-

* Letters and Papers on Philoſophical Subjects; *Letter* XV.

derate than increaſe the coldneſs of the winter winds in that part of America.

" The air over the ſea being warmer, and therefore lighter in winter than the air over the frozen land, may be another cauſe of the general north-weſt winds, which blow off to ſea at right angles from the North-American coaſt. The warm light ſea air riſing, the heavy cold land air preſſing into it's place.

" Heavy fluids deſcending, frequently form eddies, or whirlpools, as is ſeen in a funnel, where the water acquires a circular motion, receding every way from a center, and leaving a vacuity in the middle, greateſt above, and leſſening downwards, like a ſpeaking trumpet, it's big end upwards.

" Air deſcending, or aſcending, may form the ſame kind of eddies, or whirlings, the parts of air acquiring a circular motion, and receding from the middle of the circle by a centrifugal force, and leaving there a vacancy ; if deſcending, greateſt above, and leſſening downwards ; if aſcending, greateſt below, and leſſening upwards ; like a ſpeaking trumpet ſtanding with it's big end on the ground.

" When the air deſcends with violence in ſome places, it may riſe with equal violence in others, and form both kinds of whirlwinds.

" The air in it's whirling motion receding every way from the center or axis of the trumpet, leaves there a vacuum, which cannot be filled through the ſides: the whirling air, as an arch, preventing: it muſt then paſs in at the open ends.

" The greateſt preſſure inwards muſt be at the lower end, the greateſt weight of the ſurrounding atmoſphere being there. The air entering, riſes within, and carries up duſt, leaves, and even heavier bodies that happen to be in it's way, as the eddy, or whirl, paſſes over land.

" If it paſſes over water, the weight of the ſurrounding atmoſphere forces up the water into the vacuity, part of which, by degrees, joins with the whirling air, and adding weight, and receiving acclerated motion, recedes ſtill farther from the center or axis of the trump, as the preſſure leſſens; and at laſt, as the trump widens, is broken

into ſmall particles, and ſo united with air as to be ſupported by it, and become black clouds at the top of the trump.

" Thus theſe eddies may be whirlwinds at land, water-ſpouts at ſea. A body of water ſo raiſed may be ſuddenly let fall, when the motion, &c. has not ſtrength to ſupport it, or the whirling arch is broken ſo as to let in the air: falling in the ſea, it is harmleſs, unleſs ſhips happen to be under it. But if in the progreſſive motion of the whirl, it has moved from the ſea, over the land, and there breaks; ſudden, violent, and miſchievous torrents are the conſequences."

Without entering, however, into the cauſes of the frequent changes of our winds, which philoſophers are not yet agreed upon, I ſhall now proceed to the ſhepherd's rules relating to the winds.

17th *Rule.* Obſerve that in eight years time, *there is as much ſouth-weſt as north eaſt winds*, and conſequently *as many wet years as dry.*

18th *Rule.* When the wind turns to north-eaſt, and it continues there two days without

rain and does not turn ſouth the third day, nor rain the third day, *it is likely to continue north-eaſt for eight or nine days all fair*, and then *to come ſouth again.*

19th *Rule.* If it turn again out of the ſouth to the north-eaſt with rain, and continues in the north-eaſt two days without rain, and neither turns ſouth nor rains the third day, *it is likely to continue north-eaſt two or three months.*

The wind will finiſh theſe turns in three weeks.

20th *Rule.* After a northerly wind for the moſt part of two months or more, and then coming ſouth, *there are uſually three or four fair days at firſt, and then on the fourth or fifth day comes rain*, or elſe the wind turns north again, *and continues dry.*

21ſt *Rule.* If it returns to the ſouth within a day or two without rain, and turns northward with rain, and returns to the ſouth in one or two days as before, two or three times together after this ſort, *then it is like to be in the ſouth or ſouth-weſt two or three months together*, as it was in the north before.

The winds will finiſh theſe turns in a fortnight.

22d *Rule.* Fair weather for a week with a ſouthern wind, *is like to produce a great drought*, if there has been much rain out of the ſouth before. The wind uſually turns from the north to ſouth with a quiet wind without rain; but returns to the north with a ſtrong wind and rain. The ſtrongeſt winds are when it turns from ſouth to north by weſt.

When the north wind firſt clears the air, which is uſually once a week, *be ſure of a fair day or two.*

23d *Rule.* If you ſee a cloud riſe againſt the wind, or ſide wind, when that cloud comes up to you, *the wind will blow the ſame way the cloud came.* The ſame rule holds of a clear place, when all the ſky is equally thick, except one clear edge.

After carefully comparing the ſhepherd's 17th *rule* with the afore-mentioned journal of the weather, kept at Southwick near Oundle, I am ſorry to ſay that they do not agree. Leſt the reader ſhould think that juſtice is not done to the ſhepherd in this cenſure, I ſhall here

give an abſtract of every month during the eleven years that this journal was ſent to the Royal Society. It will appear from thence, that the number of days of weſterly winds greatly exceeds the number of eaſterly, and that during the eleven years, the ſum total of the ſouth-weſt doubles the number of the north-eaſt. To put it in the moſt favourable light, the greateſt number of north-eaſt winds in any year is 63 days, viz. in the year 1739; and the leaſt number of ſouth-weſt is 70 days, viz. in 1729. There is not one inſtance in the eleven years, where the eaſterly winds continued two or three months, according to the 19th *rule*. If we attend to the two great cauſes of weſterly winds, *viz.* the general north-weſt trade wind, if I may ſo call it, and the Atlantic ocean to the ſouth-weſt of us, we may rather wonder what cauſe can counteract them ſo frequently as we find the eaſterly winds do.

RESULT

OF A

JOURNAL of the WEATHER

KEPT AT

SOUTHWICK,

Near Oundle, in Northamptonſhire,

From the Year 1729 to the Year 1739,
inclusive.

	N.	N.E.	E.	S. E.	S.	SW.	W.	NW	Barom.	Rain.
1729.									○ \	in dec.
Janu.	2	2	1	3	2	10	6	4	29.70	.16
Febru.	4	2	6	5	1	1	5	4	.66	.48
March	6	3	3	2	5	3	4	5	.54	1.31
April	6	10	7	2	1		3	1	.60	1.10
May	1	4	5		3	6	6	6	.57	1.55
June	3		2	6	2	10	4	1	.69	.83
July	1	8	4		8	2	6	2	.64	2.26
Auguſt	5	1	1	1	9	6	1	5	.72	2.44
Septem		5	6	6	3	5	1	4	.42	5.32
Octo.	1	3	7	4	2	5	7	2	.52	2.20
Novem	1	1		5	4	10	4	5	.32	4.18
Decem.	1		3	5	4	12	1	5	.52	1.16
	31	39	45	39	44	70	48	44		23. 9
1730.										
Janu.	3	4	7			7	4	6	29.79	.45
Febru.	3		1	1	4	8	5	6	.39	1.53
March	1		4	4	7	7	4	3	.34	2.61
April	2	4	2		2	6	5	6	.66	84
May	4	4	2	4	6	5	3	4	.55	2.50
June	3	2	2	3	2	9	4	4	.60	3.39
July	1			1	3	10	7	9	.61	1.93
Auguſt	1	3	4	2	4	9	6	1	.70	.85
Septem	2	2	4	6	3	4	6	2	.34	1 65
Octo.	1	1	7	4	1	12	3	1	.49	2.94
Novem	2	1		1	3	9	4	10	.55	1.93
Decem.	4	3	5		2	4	5	8	.83	.81
	27	24	38	26	37	90	56	60		21.43
1731.										
Janu.	8	4	2	2		2	2	10	29 61	.81
Febru.	4	4	3	2	4	7		4	.57	1.04
March	4	5	2			5	6	9	.92	.15
April	2	11	5	3	2	1	1	3	.51	2.07
May	5	3	3	3	6	10	1	2	.72	.38
June	3	4	1	2	2	6	2	7	.66	3.38
July	3	2	2	3	2	9	2	7	.72	1.65
Auguſt	4	8	6	3	4	3	1	3	.65	1.56
Septem		2	1	4	3	10	5	5	.70	1.47
Octo.		3	1	11		12	2	2	.67	1.34
Novem	2	2	3	2	2	6	4	8	.54	1.49
Decem.	1	4	1	1		9	6	9	.61	2.30
	36	52	30	36	25	80	32	69		17.64

	N.	N.E.	E.	S. E.	S.	S W.	W	NW	Barom.	Rain.
									o '	in dec.
1732.										
Janu.	1	5	2	4	5	9	1	4	29.54	.88
Febru.		1		3		16	3	6	.65	1.22
March	4	2	3	1	1	8	1	11	.57	1.41
April	8	3	1	2	4	5	1	6	.52	1.20
May	3	5		2	4	10	5	2	.50	3.47
June	2	6	5	2		4	4	7	.75	.61
July	2	6		2	3	10	8	5	.65	1.77
Auguſt	2	1	5			10	5	2	.70	1.67
Septem	1	3	5	3	1	9	5	3	.63	.72
Octo.		1	5	4	4	10	1	5	.68	3.73
Novem	4	8	3	3			1	8	.75	1.21
Decem	2	4	5	6	4	7	3	2	.47	2.63
	29	45	34	32	26	98	38	61		20.42
1733.										
Janu.	1	1	3	5	8	11	1		29.68	1.01
Febru.					4	14	5	5	.55	1.43
March	2	7	3	3	1	6	3	6	.43	2.25
April	2	10	3	3	4	1	3	4	.65	1.04
May	8	9	6	3			3	1	.70	.02
June	1	2	3	6	1	10	2	4	.67	2.04
July	3	3	1	4		3	5	12	.67	2.17
Auguſt		2	1		1	11	2	11	.56	3.58
Septem	2	1	2	3	1	12	1	7	.62	1.45
Octo.		2	4	3		8		10	.72	.62
Novem		1	1	3	1	12	5	7	.75	.49
Decem			1	1	3	20		5	.53	1.70
	19	38	28	34	24	108	30	72		17.80
1734.										
Janu.	2	2	4	3	4	7	1	8	29.80	.50
Febru.		1			2	10	2	13	.60	2.57
March			1	3	3	12	2	9	.52	1.85
April	2	4	3	3	1	11	2	4	.65	.59
May	3	2	1	5		6	2	11	.54	5.12
June	2	4	3	4	1	6	4	6	.65	1.32
July	3	2	3	2	2	5	8	5	.63	1.76
Auguſt	3	2		4		13	1	8	.57	4.06
Septem	5		1	1		12	3	7	.57	1.73
Octo.	3	7	2		2	7	2	6	.47	2.83
Novem	1	11	3	1		9	3	2	.74	.94
Decem.	1		1	2	2	20	3	1	.22	4.40
	25	35	22	28	17	118	33	80		27.67

	N	N.E.	E.	S. E.	S.	SW.	W	NW	Barom.	Rain.
									o ′	in. dec.
1735.										
Janu.		4	1	2	2	7	2	13	29.47	2.07
Febru.	3	1		2		15	2	4	.63	.69
March		10	5	3	3	4	2	4	.36	2.21
April		4	1	2	1	15	3	4	.49	1.65
May	11	3	2	1		5	1	7	.60	1.53
June	3	2		2	3	7	4	8	.56	2.36
July	2	1	1	3	2	13	2	4	.50	2.29
Auguſt	2	3	2	3	3	9	4	4	.72	3.23
Septem	1	5	1	5		13	3	2	.69	3.17
Octo.		5	6	7	2	2	2	5	.69	1.68
Novem		2		6	8	5	3	5	.45	1.67
Decem		1	7	4	4	8	2	5	.59	2.11
	22	41	26	40	28	103	30	65		24.66
1736.										
Janu.		3	1	7	3	11	4	1	29.26	2.32
Febru.	1	10	2	3		4	1	8	.22	2.94
March		6	4	7		10	3	1	.44	2.06
April		2	2	2	3	5	7	9	.70	.56
May	2	10	2	5	1	3	2	5	.58	.81
June	3	11	1	2		2		11	.76	1.36
July	2	7		5	1	8	1	7	.67	5.90
Auguſt	2	2	2	3	1	14	1	5	.63	1.74
Septem	1			1	3	8	4	13	.71	1.40
Octo.	1	2	3	4	5	10	4	2	.33	2.63
Novem		2	1	2		8	3	14	.64	.59
Decem	1			1		16	1	12	.53	1.98
	13	55	18	42	17	99	31	88		24.29
1737.										
Janu.	1	2				11	2	16	29.86	.98
Febru.	1	1		1		16	2	7	.58	2.45
March	1	10	3	4		10	1	1	.67	.45
April	2	4	3	5	1	7	3	6	.45	2.12
May	4	9	4	7	1	2	1	2	.70	1.67
June	5	3		2	3	6	3	8	.73	1.83
July		4		3	3	9	4	8	.59	.67
Auguſt	1	1	1		2	5	5	16	.55	5 69
Septem	1	3	1	5	4	6	4	6	.46	3.83
Octo.	4	12	2		1	5	2	4	.60	1.84
Novem	1	3	2		2	8	2	12	.68	.60
Decem	1	5	1	9	1	8	2	4	.70	2.32
	22	57	17	36	18	93	31	90		24.25

	N.	N.E.	E.	S.E.	S.	SW	W.	NW	Barom.	Rain.
1738.									° ′	in. dec.
Janu.				1		16	6	8	29.70	1.70
Febru.	2	4		5	1	7	1	8	.61	.81
March		4			3	11	1	12	.46	.99
April	3	7		4	3	8		5	.53	1.31
May	1	5		6	3	11	3	2	.52	1.90
June	2	1		1	1	12	3	9	.50	3.42
July	1	2	3	3	1	12	2	7	.72	1.17
Auguſt	1	2			2	12	5	9	.60	1.57
Septem	1	9	1	1		11	3	3	.65	1.75
Octo.	1	1	2	4	2	9	1	7	.52	1.80
Novem	2	2	1	4	3	10		5	.67	.71
Decem	2	6			2	13	1	7	.58	1.22
	16	43	7	29	21	132	26	82		18.35
1739.										
Janu.				2	2	22		5	29.45	2.37
Febru.	1	1			2	15	1	8	.60	3.11
March	1	10		1		4	1	13	.48	2.27
April	1	6	3	3	2	5		10	.34	1.17
May	1	10	1	2	3	11	1	2	.60	1.93
June		2	1	2	2	18	2	1	.56	1 54
July		7	1	1		13	2	7	.67	2.67
Auguſt	2	1	1	3	2	9	1	11	.61	1.57
Septem		2	5	6	3	8		6	.49	.85
Octo.		17	2	5	1	5	1		.71	.78
Novem	1	2	4	6	1	6	3	7	.32	1.70
Decem	2	5	8	3	1	9		3	.65	1.88
	9	63	26	34	19	125	12	73		22.84
									Rain.	
Janu.	18	27	21	29	26	113	29	75	13.23	
Febru.	19	25	12	22	18	113	27	73	18.07	
March	20	51	28	29	24	77	30	79	18.23	
April	27	71	30	28	23	67	26	53	12.98	
May	43	64	26	38	27	69	28	44	20.88	
June	27	37	18	32	17	90	32	66	22.08	
July	18	37	15	27	25	94	47	73	23.24	
Auguſt	23	31	23	19	28	101	32	75	28.96	
Septem	14	32	27	41	21	98	35	58	24.35	
Octo.	11	54	41	46	20	85	25	44	22.39	
Novem	14	35	18	33	24	83	32	83	15.51	
Decem	15	28	32	32	23	126	24	61	22.51	
	249	492	291	376	276	1116	367	784	242.43	

Total of the Winds and Quantity of Rain in each Year during the 11 Years.

The ſhepherd's obſervation of the manner in which the winds ſettle in the eaſt or ſouth-weſt, is particularly worthy the farmer's attention, becauſe it will lead him to moſt uſeful foreknowledge. It is however proper to obſerve, that as great part of England is an open country, at leaſt free from high hills, the winds and weather are more regular there, than in mountainous countries, or where the coaſt is interſected by arms of the ſea. The ſhepherd's remark made in the middle of that delightful plain which conſtitutes the greateſt part of England, will therefore not hold ſo true in other places differently ſituated.

When he tells us, that in eight years we have as many wet as dry, he does not aſcertain what winds bring rain or fair weather; and, as Mr. Worlidge obſerves, "that wind which brings rain to one part of the iſland, may not to another: for on whichever coaſt the ſea is neareſt, the wind more frequently brings rain to that place, than to another where the ſea is more remote. Therefore," ſays he, "I deſire all ſuch as expect any ſucceſs to

their obſervations, that they quadrate the rules to the place where they live, and not truſt to the obſervations of other places."

Southerly and weſterly winds prove generally rainy in this iſland, there being ſo great an extent of ſea to the ſouth-weſt: yet places far diſtant from that ſea, or which are ſcreened from it by high mountains, have fair weather; as is the caſe on the north-eaſt coaſt of Scotland, where the vapours are intercepted by the Grampian hills. The eaſterly winds, coming to the ſouth part of the iſland over a narrow tract of ſea, are generally fair, except when in winter they bring on that dark, heavy ſky, deſcribed by Dr. Derham. They are extremely ſharp and cold in the winter, coming from a frozen continent; but if inclined to the ſouth, are hot and dry in the ſummer, as coming from the continent then heated by the ſun. The eaſterly winds croſſing a much wider ſea in their paſſage to Scotland, prove generally rainy all along the eaſt of that country; but fair on the weſt. We may eaſily conceive that the air, in croſſing the German

ocean, may take up water enough to cauſe this rain, by it's faculty of attracting water, before mentioned.

A wind blowing from the ſea is obſerved to be always moiſt; cold in ſummer, and warm in winter, unleſs the ſea be frozen up: (*i. e.* the temperature of wind blowing over water, is more equal than that of wind blowing over land:) and winds blowing from large continents are dry, warm in ſummer, and cold in winter. If the froſt is ſo great as to freeze the vapour as it riſes from the ſea, it muſt feel extremely ſharp and cold to our bodies; though by the thermometer the cold may be the ſame as in lofty ſituations to which ſuch heavy vapours ſeldom aſcend in winter. This frozen vapour acting as ſo many ſharp points, may be eaſily conceived to produce thoſe miſchievous effects on tender vegetables, which I noticed in a former work*, as one of the diſadvantages of low ſituations.

A remarkable proof of this (as I likewiſe mentioned in the ſame place) occurred on the firſt ſettlement of the Engliſh in North-

* Syſtem of Huſbandry, vol. 3, p. 461.

America. They imitated our cuſtom of building in vallies, and near rivers: but experience ſoon taught them, that ſuch places are more ſubject to the ſuffocating, ſultry heat of the ſummer; and, what they little expected, to a greater ſeverity of froſt in the winter, than riſing grounds generally are. I have been informed by one of the moſt curious and intelligent obſervers of the laws of nature, that the cold there, in their hardeſt froſts, is found to be ſo ſevere in the vallies, to a certain height, as ſometimes to kill every tender vegetable, while thoſe on the higher grounds eſcape. This generally takes place to a regular, determined height, above which the Americans now build their houſes. — If I might offer a conjecture concerning the cauſe of this, I ſhould ſay, that the effect of the cold ſeems to be limited to the height to which the great moiſture of the air riſes at that ſeaſon. In the hard winter of 1739-40 the ſame happened in this kingdom, when the froſt was much leſs ſevere in it's effect in the hilly countries, than in the low lands.

Lord Bacon obſerves, that, " when the wind changes conformable to the motion of the ſun, that is from eaſt to ſouth, from ſouth to weſt, &c. it ſeldom goes back; or if it does, it is only for a ſhort time: but if it moves in a contrary direction, *viz.* from eaſt to north, from north to weſt, it generally returns to the former point, at leaſt before it has gone quite through the circle. When winds continue to vary for a few hours, as if it were to try in what point they ſhould ſettle, and afterwards begin to blow conſtant, they continue for many days. If the ſouth wind begins to blow for two or three days, the north wind will blow ſuddenly after it: but if the north wind blows for the ſame number of days, the ſouth will not riſe till after the eaſt has blown a while. Whatever wind begins to blow in the morning, uſually continues longer than that which riſes in the evening."

Mr. Worlidge obſerves, that " if the wind be eaſt or north-eaſt in the fore part of the ſummer, the weather is likely to continue dry: and if weſtward toward the end of the

ſummer, then will it alſo continue dry. If in great rains the winds riſe or fall, it ſignifies that the rain will forthwith ceaſe. If the colours of the rain-bow tend more to red than any other colour, wind follows; if green or blue predominate, then rain."

The moſt conſiderable thing with regard to the barometer, which marks the weight of the air, is, as M. de la Hire has obſerved in the Memoirs of the Royal Academy of Sciences for the year 1704, the changes which happen to it in two or three days, wherein we often ſee it deſcend, and riſe more than an inch. This ſhews that there muſt be great variations in a little time in the height of the atmoſphere. "In order to account for theſe different weights of the air, ſays he, it does not appear to me probable to ſuppoſe, as ſome philoſophers do, different liquids, and of different gravities, on the ſurface of the earth, which are ſometimes carried one way, and ſometimes another; for we know by obſervation, that the air is commonly lighteſt, when moſt loaded with vapour.

"I think one may very well explain, in

the following manner, all that we obſerve of the weight of the air or atmoſphere, in all it's circumſtances. We know, by very exact obſervations, that the barometer riſes in general leſs high between the tropics than in the northern countries; from whence it may be conjectured, that the figure of the atmoſphere is an oblong ſpheroid, whoſe axis correſponds with that of the earth. Now, as wherever there is air, there may be winds; if the ſame wind reigns through the whole maſs of air, and comes from the ſouth, it will neceſſarily lower the height of the atmoſphere in thoſe countries; and on the contrary, if it comes from the north, it will raiſe it. But moreover, as winds from the ſouth bring us rain, it will follow, that it ſhould rain when the air will appear lighter: the entire contrary muſt happen from the oppoſite quarter.

"This is, in general, what muſt follow from the foregoing ſuppoſition: but if the ſouth wind reigns only near the ſurface of the earth, and there be a northerly wind in the ſuperior region, it may rain although the

air appear very heavy; and by a contrary reaſon, it may be very fine weather with a northerly wind, and the barometer extremely low; for we can only obſerve the winds that are near the ſurface of the earth."

That different winds do rule in the air at the ſame time, and ſometimes entirely oppoſite ones, is frequently evident from the driving of the clouds in different directions. It may happen that the combat of theſe different winds may occaſion ſtorms and hurricanes, which Virgil alludes to in his deſcription of a ſtorm, when he ſays,

" South, eaſt, and weſt with mix'd confuſion roar." ÆNEID. B. I.

The ſame prince of poets has elegantly ſhewn his ſkill in philoſophy, and at the ſame time in phyſic, with regard to the influence of the air on animal bodies, in the following lines; which confirm what was before noticed in Sect. II, and might indeed properly have been added thereto:

" But with the changeful temper of the ſkies,
" As rains condenſe, and ſun-ſhine rarefies;
" So turn the ſpecies in their alter'd minds,
" Compos'd by calms, and diſcompos'd by winds:

" From hence proceeds the bird's harmonious voice,
" From hence the crows exult, and friſking lambs
rejoice. GEORG. I.

" I am perſuaded, ſays M. de la Hire,* that fair or rainy weather do not depend on the weight or lightneſs of the air; but that they are occaſioned ſolely by the winds: I do not mean the wind in general, but ſuch winds as come from a diſtance from the north and ſouth, and occupy the greateſt part of the atmoſphere, and not ſuch as are produced near the ſurface of the earth: for the ſun raiſing more vapours in the ſouthern countries than in the northern, the ſouthern winds moſt commonly give more rain than the northern: and as we know by all the obſervations which have been made towards the north, that the atmoſphere there is higher than towards the equator, it muſt happen, that the winds which ſhall blow from the north will cauſe the atmoſphere to riſe in our temperate zone more than uſual; and by conſequence the mercury will be

* *Memoires de l'Academie Royale des Sciences, pour l'an* 1715.

raiſed by the greater weight of the atmoſphere; and the air will become ſerene by ſuch a wind. The contrary muſt happen with regard to the winds which ſhall blow from the ſouth upon theſe countries.

" One may conſider the heat of 1718, continues he,* as the greateſt we had obſerved at Paris: not but that the thermometer had in like manner riſen to 82 degrees in the years 1706, 1707 and 1709; but then it roſe to that point only once in each of theſe years; whereas in 1718 it roſe to that height four different days, *viz.* Auguſt 11th, 21ſt, 22d, 23d; and it is that continued heat, although of the ſame degree, which makes us feel it's power. The thermometer roſe at ſun-riſing to 70 degrees on the 22d.

" Some have imagined † that the greater or leſs heat, which glows in the ſame ſeaſon in different years, may ariſe from the ſpots that are obſerved at the ſame time in the

† *Memoires de l'Academie Royale des Sciences, pour l'an* 1718.

* *Ibid. pour l'an* 1719.

ſun; and as when that planet is ſpotted it does not throw forth ſo great a number of rays to the earth, that the heats muſt of conſequence be leſs than when it has no ſpots. But the experience we have had the two preceding years ſhews, that this explanation is not ſufficient: for during theſe years, 1718 and 1719, we ſeldom ſaw the ſun without ſpots; and ſometimes there were ſo great a number of them at once, that we counted nine or ten at the ſame time, the greateſt part of which were very large: yet notwithſtanding ſo many ſpots during theſe two laſt years, the heat was remarkably violent, and of long continuance; for in the laſt of theſe years it continued from the beginning of June to the middle of September. Thus it appears that the different temperature of the ſame ſeaſon in different years, cannot be attributed to the ſpots of the ſun, but may more probably be owing to the different exhalations of the earth, ſometimes colder, ſometimes hotter, and to the diverſity of winds which rule in the ſame ſeaſons, and which have not, ſo far as we know at preſent, any regular periods in our climates."

SECTION VIII.

Prognoſtics of the Weather taken from the Changes of the Seaſons.

AS every year, and the various ſeaſons of each year, have a peculiar character by which they may be diſtinguiſhed, as to heat, cold, drought, rain, &c. and as the quality of the ſeaſons has a moſt ſenſible effect on the productions of the earth, it is evident, that it muſt be of the greateſt advantage to the farmer to be able to foreſee the nature of the enſuing ſeaſon, becauſe he can thereby ſuit the culture of his grounds, and his crops, to the weather expected.

The antients had certainly arrived at a more perfect knowledge in this article, than we are poſſeſſed of. They, obſerving that the weather of each ſeaſon ſet in at a ſtated time, imputed it's quality to the influence of certain ſtars which happened then to be conſpicuous. In after ages, monks and deſigning prieſts, deſirous to aſcribe every merit

to their ſaints, transferred the ſuppoſed influence of the ſtars to the ſaints whoſe commemoration happened near the ſame time. The moderns, being ſenſible that the inconceivable diſtance of the fixed ſtars, and the ſmallneſs of our neareſt planets, muſt render their influence on our atmoſphere of no effect, and having but little faith in ſaints, have, perhaps injudiciouſly, rejected the obſervations of the antients, without conſidering, that the facts might have been diſcovered firſt, and the ſtars and ſaints only called in to account for them. The antients acted more rationally than the monks, in not fixing theſe changes of the weather to particular days, but only to a ſtated time of the year, as appears from Pliny and other writers on this ſubject.

By the help of the barometer, we ſeem to regain that foreknowledge of the weather which ſtill reſides in brutes, and which we forfeited, both by not continuing in the open air as they generally do, and by our intemperance's leſſening our ſenſibility of external objects.

Authors are generally agreed, that the riſing of the mercury forebodes fair after foul, with eaſterly or north-eaſterly winds; and that it's falling portends ſoutherly or weſterly winds, either ſtormy, or with rain.

The more northerly places experience greater alterations in the barometer, than the more ſoutherly. Within the tropics, or near them, there is little or no variation in the height of the mercury.

In ſerene ſettled weather, the barometer is high. Other things equal, the greateſt heights of the mercury are upon eaſterly and north-eaſterly winds. During great winds, though unaccompanied with rain, the mercury is loweſt of all, eſpecially if the wind be ſoutherly. After great ſtorms of wind, when the mercury has been low, it generally riſes again. Other things equal, the mercury is higher in cold weather than in warm, and uſually more ſo in the morning and evening, than at mid-day.

When the character of the ſeaſon is once aſcertained, the returns of rain, or fair weather, may be judged of with ſome degree of

certainty in ſome years, though but ſcarcely to be gueſſed at in others, by means of the barometer; for, in general, we may expect, that when the mercury riſes high, a few days of fair weather will follow. If the mercury falls again in two or three days, but ſoon riſes high, without much rain, we may expect fair weather for ſeveral days; and in this caſe, the cleareſt days are after the mercury begins to fall. In like manner, if the mercury falls very low, with much rain; riſes ſoon, but falls again in a day or two, with rain; a continuance of bad weather may be feared. If the ſecond fall does not bring much rain, but the mercury riſes gradually pretty high, it prognoſticates ſettled good weather of ſome continuance. When a heavy rain has fallen upon the mercury's ſinking, and it's continuing ſteadily low, the weather is ſometimes fair, and promiſes well; but no prudent man ſhould truſt to ſuch appearances. There is indeed a caution of this kind which the pooreſt may profit by. When the mercury riſes high in the barometer, the air ſucks up all the moiſture on the ſurface of the earth,

even though the ſky be overcaſt, and that is a ſure ſign of fair weather: but if the earth continue moiſt, and water ſtands in ſhallow places, no truſt ſhould be put in the cleareſt ſky, for in this caſe it is deceitful.

Towards the end of March, or more generally in the beginning of April, the barometer ſinks very low, with bad weather; after which, it ſeldom falls lower than 29° 5′, till the latter end of September or October, when the quickſilver falls again low, with ſtormy winds, for then the winter conſtitution of the air takes place: from October to April, the great falls of the barometer are from 29° 5′ to 28° 5′; ſometimes lower: whereas during the ſummer conſtitution of the air, the quickſilver ſeldom falls lower than 29° 5′. It therefore follows from hence, that a fall of one tenth of an inch, during the ſummer, is as ſure an indication of rain, as a fall of between two and three tenths is in the winter.

It muſt, however, be obſerved, that theſe heights of the barometer hold only in places nearly on a level with the ſea; for experi-

ments have taught us, that for every eighty feet of nearly perpendicular height that the barometer is placed above the level of the ſea, the quickſilver ſinks one tenth of an inch: now by an accurate compariſon between the motion of the barometer in inland and higher places, with it's motion in a place on a level with the ſea, the heights of theſe inland places may be pretty nearly aſcertained; and obſervations muſt determine the heights of the quickſilver, which in each place denote either fair or foul weather.

In all places nearly on a level with the ſea, rain may be expected when the quickſilver falls below thirty inches. This points out one cauſe of the more frequent rains in lofty ſituations, than in low open countries. Thus double the quantity of rain falls at Townly-hall in Lancaſhire, that does at London.

Very heavy thunder ſtorms happen, without ſenſibly affecting the barometer; and in this caſe the ſtorm ſeldom reaches far. When a thunder ſtorm is attended with a fall of the barometer, it's effect is much more extenſive.

And here I muſt mention an obſervation which has often been verified by a friend of mine who keeps a regular journal of the weather, viz. that when the quickſilver falls very low, and the weather continues mild and the wind moderate, there is at the ſame time a violent ſtorm in ſome diſtant place: this accounts for a falſe prognoſtic, often unjuſtly laid to the charge of the barometer; and was ſignally inſtanced in the remarkably great fall of the barometer on the 22d of November laſt (1768), when the quickſilver fell in the night to nearly 28° 3 inches. The weather here (in London) was then mild, with little rain, and the wind moderate; and accounts have ſince been received of a violent ſtorm of wind at the ſame time in the Atlantic ocean, weſt of England and Ireland, which extended to the Engliſh and St. George's channels.

That valuable friend of mankind, Benjamin Franklin, LL. D. F. R. S, and honorary member of the Royal Academy of Sciences at Paris, whoſe piercing eye and comprehenſive judgment let nothing eſcape him,

has, in one of his philoſophical letters*, by a ſingle inſtance, accounted more rationally for the cauſes and progreſs of ſtorms, than all who have gone before him have done; with this farther advantage, that his reaſoning is confirmed by obſervation.

"I think, ſays he, that our *north-eaſt ſtorms* in North-America begin firſt, in point of time, in the *ſouth-weſt* parts: that is to ſay, the air in Florida and Georgia, the fartheſt of our colonies to the *ſouth-weſt*, begins to move *ſouth-weſterly* before the air of Carolina, which is the next colony *north-eaſtward*; the air of Carolina has the ſame motion as the air of Virginia, which is ſtill more *north-eaſtward*; and ſo on *north-eaſterly* through Penſilvania, New-York, New-England, &c. quite to Newfoundland.

"Theſe *north-eaſt* ſtorms are generally very violent, continue ſometimes two or three days, and often do conſiderable damage in the harbours along the coaſt. They are attended with thick clouds and rain.

* Letter XXXVI.

"What firſt gave me this idea, was the following circumſtance. About twenty years ago, a few more or leſs, I cannot from my memory be certain, we were to have an eclipſe of the moon at Philadelphia, on a Friday evening about nine o'clock. I intended to obſerve it, but was prevented by a *north-eaſt* ſtorm, which came on about ſeven, with thick clouds as uſual, that quite obſcured the whole hemiſphere. Yet when the poſt brought us the Boſton news-paper, giving an account of the effects of the ſame ſtorm in thoſe parts, I found the beginning of the eclipſe had been well obſerved there, though Boſton lies *north-eaſt* of Philadelphia about four hundred miles. This puzzled me, becauſe the ſtorm began with us ſo ſoon as to prevent any obſervation, and being a *north-eaſt* ſtorm, I imagined it muſt have begun rather ſooner in places farther to the *north-eaſtward*, than it did at Philadelphia. I therefore mentioned it in a letter to my brother who lived at Boſton; and he informed me the ſtorm did not begin with them till near eleven o'clock, ſo that they had a good ob-

ſervation of the eclipſe: and upon comparing all the other accounts I received from the ſeveral colonies, of the time of the beginning of the ſame ſtorm, and ſince that of other ſtorms of the ſame kind, I found the beginning to be always later the farther *north-eaſtward*. I have not my notes with me here in England, and cannot, from memory, ſay the proportion of time to diſtance; but I think it is about an hour to every hundred miles.

"From thence I formed an idea of the cauſe of theſe ſtorms, which I would explain by a familiar inſtance or two—Suppoſe a long canal of water ſtopped at the end by a gate. The water is quite at reſt till the gate is open, then it begins to move out through the gate; the water next the gate is firſt in motion, and moves towards the gate; the water next to that firſt water moves next, and ſo on ſucceſſively, till the water at the head of the canal is in motion, which is laſt of all. In this caſe all the water moves indeed towards the gate, but the ſucceſſive times of beginning motion are the contrary way, viz.

from the gate backwards to the head of the canal.—Again, ſuppoſe the air in a chamber at reſt, no current through the room till you make a fire in the chimney. Immediately the air in the chimney being rarefied by the fire, riſes; the air next the chimney flows in to ſupply it's place, moving towards the chimney; and, in conſequence, the reſt of the air ſucceſſively, quite back to the door. Thus, to produce our *north-eaſt* ſtorms, I ſuppoſe ſome great heat and rarefaction of the air in or about the gulph of Mexico; the air then riſing has it's place ſupplied by the next more northern, cooler, and therefore denſer and heavier air; that, being in motion, is followed by the next more northern air, &c. &c. in a ſucceſſive current, to which current our coaſt and inland ridge of mountains give the direction of *north-eaſt*, as they lie *north-eaſt* and *ſouth-weſt*.

" This I offer only as an hypotheſis to account for this particular fact; and, perhaps, on farther examination, a better and truer may be found. I do not ſuppoſe all ſtorms generated in the ſame manner. The north-

weſt thunder-guſts in America, I know are not."

If accounts from different parts of Europe were compared on the above-mentioned very great fall of the barometer on the 22d of November, 1768, with the ſame accuracy as was done in America by the judicious Dr. Franklin, the origin and progreſs of ſtorms which probably accompanied this fall, might be traced. To our woeful experience, we in England long felt the conſequences of the effects which attended the ſubſequent fall of the barometer, from the 30th of November to the 3d of December of the ſame year, in the deluges of rain which fell almoſt univerſally.

Heretofore, the general idea was, that the progreſs of the ſtorm was to be eſtimated by the celerity of the wind: and hence a velocity was ſometimes aſſigned to the wind, which perhaps ſcarcely ever exiſted; as Dr. Franklin's obſervations have fully proved.

Certain it is, that the character of the ſeaſon is leſs ſteady at the equinoxes, and more regular during the intermediate months. The

advocates for the celeſtial influence on the atmoſphere think, that the changes of the weather are in a great meaſure regulated by the moon's place in the zodiac, or by her ſituation with reſpect to the ſun: but obſervation has not yet aſcertained any thing on this head.

Whatever the cauſes of the changes in the weather, or, what is nearly the ſame, in the motion of the quickſilver in the barometer, may be, whether celeſtial or terreſtrial, their effects are generally felt over a conſiderable extent of country at the ſame time. Every one may be aſſured of this, by comparing accounts kept at diſtant places, of the play of the barometer. They will find, that the great falls or riſes of the mercury happen nearly at the ſame time, in almoſt all the northern countries of Europe; I ſay nearly, becauſe a difference will be obſerved, uſually attending the direction of the wind. If theſe cauſes were celeſtial, the effects would be univerſally the ſame, except where varied by the ſituations with regard to ſeas, mountains, &c. As this is not the caſe, the

cauſes muſt probably be ſought for in the earth. This opinion is favoured by the obſervations of miners, who have been generally ſenſible of ſome prognoſticating circumſtances in mines, before any change of the weather appeared in the air.

The hurricanes which deſolate Saxony are all formed in, or at leaſt all proceed from the mines in the mountains of Freyberg, ſituated ſouth-weſt of Dreſden and ſouth-eaſt of Leipzig; as is remarked by Count Algarotti, in his 8th letter to Lord Hervey.*

Even the limited fore-knowledge above pointed out would be of great uſe to the huſbandman, if duly attended to; for inſtance, at the time of hay-making, when it would be of conſiderable advantage for him to be able to judge whether he may cut his graſs with a proſpect of fair weather to dry it; and at all times of the year, in order to his getting ready every thing neceſſary for carrying into execution the works proper for each ſeaſon.

Beſides a barometer, for the purpoſes

* *See* ALGAROTTI's *Letters upon* Ruſſia.

above-mentioned, it is likewiſe neceſſary for whoever would keep an exact regiſter of the weather, to be alſo provided with a thermometer, in order to notice and mark down the changes which happen in the heat or temperature of the air. This is not a matter of curioſity only, but of real utility: for, from the changes in the temperature of the air, which attend every change of weather, ſome happy genius may poſſibly diſcover cauſes of the alterations in the degrees of heat, which may lead to a more ſatisfactory account than any we yet have, of the changes of the year.

Every change of the weather is attended with a change in the temperature of the air, which a thermometer placed in the open air, will point out, ſometimes before any alteration is perceived in the barometer. This change in the temperature of the air ariſes from cauſes yet unknown to us, and of which the diſcovery ſhould be the object of the curious obſerver. The early intimations of changes in the weather given to miners, when working deep under ground, makes it probable, that the temperature of the air de-

pends much on what paſſes beneath the ſurface of the earth; and this is confirmed by every general thaw, in which the ice is as much melted in the under part (and thereby looſened from the earth,) as it is on the ſurface. The uncommon degree of heat which ſometimes happens in the winter and early in ſpring, muſt likewiſe be occaſioned by ſomewhat proceeding from the earth; as does alſo, probably, the ſultry heat frequent in the ſummer, and which is generally the forerunner of thunder.

The knowledge of the exact degree of cold in the winter, is of conſequence to the farmer; for it has been obſerved, that when the froſt is ſo keen as that the thermometer ſinks fourteen degrees on Fahrenheit's ſcale, moſt ſucculent vegetables are thereby deſtroyed, ſuch as almoſt all the cabbage or kale tribe, turneps, &c. for their juices being then frozen hard, their veſſels are thereby torn aſunder or ſplit, ſo that when the thaw comes on, the whole ſubſtance, for inſtance of turneps and apples, runs into a putrid maſs. In this caſe, the moſt likely

way to prevent their being loſt, or at leaſt to prevent a total loſs of them, is to immerſe what is ſo frozen in cold water, till the froſt is extracted by the water: the loſs is thereby delayed a little, and indeed only delayed; for what is not uſed very ſpeedily, will ſoon putrefy, notwithſtanding this care. The knowledge of this conſequence of ſo ſevere a froſt, may however put the farmer on ſome method of repairing the loſs he ſees coming on. Time may point out other uſeful obſervations, which may ariſe from the knowledge of what may be diſcovered from the changes in the thermometer.

A ſtrict obſerver of the weather may alſo, rightly, wiſh to keep an account of the degree of moiſture of the air, or at leaſt of its ſenſible variations. There are ſeveral means of doing this; for whatever body either ſwells or ſhrinks by moiſture or dryneſs, is capable of being formed into an hygrometer: ſuch are moſt kinds of wood, eſpecially white wood, as poplar, birch, plane, aſh; even deal will do. On this principle it is, that wedges of well-dried wood are made uſe of

to cleave or raiſe rocks or ſtones: for as the moiſture of dew, rain, or water applied to them, enters into them, they ſwell and overcome an inconceivable reſiſtance. Ropes or ſtrings made of hemp, flax, or any other vegetable ſubſtance, become alſo hygrometers. This is well known to ſailors, who, according to the dryneſs or moiſture of the air, find the ſhrouds of their veſſels ſlack or tightened, ſo as, in the latter caſe, to be in danger of breaking. The uſe that was made of water applied to the tackle employed in raiſing the famous obeliſk at Rome, is well known.

Stretch a cord or fiddle-ſtring, faſtened at one end over a pulley, and to the other end tie a weight: this will riſe or fall as the air becomes dry or moiſt, and conſequently be an hygrometer.

Animal ſubſtances twiſted and dried anſwer the ſame purpoſes, as fiddlers often find to their coſt, when the too great moiſture of the air breaks their ſtrings.

A great misfortune attending the uſe of all theſe ſubſtances is, that by uſe they become ſenſibly leſs and leſs accurate, ſo as at length

not to undergo any visible alteration from the different states of the air, in regard to dryness or moisture. On this account a sponge may be preferred, as being less liable to be so changed. To prepare the sponge, first wash it in water, and when dry, wash it again in water wherein Sal Ammoniac, or salt of Tartar, has been dissolved; and let it dry again. Now, if the air becomes moist, the sponge will grow heavier; and if dry, it will become lighter.

Oil of vitriol is found to grow sensibly lighter or heavier in proportion to the lesser or greater quantity of moisture it imbibes from the air. The alteration is so great, that it has been known to change it's weight from three drams to nine. The other acid oils, or, as they are usually called, spirits, or oil of tartar *per deliquium*, may be substituted in lieu of the oil of vitriol.

In order to make an hygrometer with these bodies which acquire or lose weight in the air, place such a substance in a scale on the end of a steel-yard, with a counterpoise which shall keep it in equilibrio in fair weather:

the other end of the ſteel-yard, riſing or falling, and pointing to a graduated index, will ſhew the changes. Whoever would be more accurately informed, may conſult the Philoſophical Tranſactions.

It was obſerved by the antients, that the early or late arrival of birds of paſſage indicates the nature of the approaching ſeaſon; whether it will be early or late, ſevere or mild. In the ſame manner, Linnæus adviſes huſbandmen to mark the firſt ſigns of a beginning vegetation of ſuch plants as grow wild, and are natives of the climate; for that they, by their early or late ſhooting, inform the attentive farmer of the approach of ſpring. He adviſes the huſbandman to extend theſe remarks to different plants, whoſe vegetation has been obſerved to coincide with the times of ſowing particular ſeeds. Theſe are objects highly worthy of a place in ſuch a journal of the weather as there ſtill remains too much room to wiſh for; becauſe facts of this kind would remain, from year to year, a regiſter of the ſtate of every article any way relative to rural oeconomics: and upon this

principle it is, that M. Duhamel has very judiciouſly added to his journal of the weather, an account of the ſtate of all the vegetables and animals uſeful in a farm; or, which is the ſame, of the effects of the weather on them.

The only method by which the changes of the weather can be traced with preciſion, undoubtedly is to keep regular regiſters of the weather, and mark every appearance in the heavens or on the earth, which may tend to point out the approaching ſeaſons. The very buſineſs of the farmer neceſſarily keeping him much in the open air, would render this an eaſy taſk to him; and his progreſs in fixing facts, and in drawing judicious concluſions from them, would perhaps be much more ſpeedy and ſucceſsful than he himſelf might expect.

Having but few rules relative to the Changes of the Seaſons, founded on obſervations, unleſs the ſhepherd of Banbury's be reckoned ſuch, I ſhall endeavour to collect the moſt rational that I have met with, and accordingly begin with his

24th *Rule.* If the laſt eighteen days of *Fe-*

bruary and the firſt ten days of *March* * be for the moſt part *rainy*, then *the ſpring and ſummer quarters will be ſo too:* and I never knew *a great drought but it entered in at that ſeaſon.*

25th *Rule.* If the latter end of *October* and beginning of *November* be for the moſt part *warm and rainy*, then *January and February are like to be froſty and cold*, except after a very dry ſummer.

26th *Rule.* If *October* and *November* be ſnow and froſt, then *January and February are like to be open and mild.*

Mr. Claridge gives us the following obſervations made by our forefathers;

Janiveer freeze the pot by the fire.
If the graſs grow in *Janiveer*,
It grows the worſe for't all the year.
The Welchman had rather ſee his dam on the bier,
Than ſee a fair *Februeer.*
March wind and *May* ſun
Makes cloaths white, and maids dun.
When *April* blows his horn,
It's good both for hay and corn.

* It is to be obſerved, that the ſhepherd reckons by the old ſtile.

An *April* flood
Carries away the frog and her brood.
A cold *May* and a windy
Makes a full barn and a findy.
A *May* flood never did good.
A ſwarm of bees in *May*
Is worth a load of hay.
But a ſwarm in *July*
Is not worth a fly.

The following rules are laid down by Lord Bacon:

If the wainſcot or walls that uſed to ſweat be drier than uſual, in the beginning of winter, or the eves of houſes drop more ſlowly than ordinary, it portends a hard and froſty winter: for it ſhews an inclination in the air to dry weather, which, in winter, is always joined with froſt.

Generally, a moiſt and cool ſummer portends a hard winter.

A hot and dry ſummer and autumn, eſpecially if the heat and drought extend far into September, portend an open beginning of winter, and cold to ſucceed towards the latter part of the winter, and beginning of ſpring.

A warm and open winter portends a hot and dry ſummer; for the vapours diſperſe into the winter ſhowers: whereas cold and froſt keep them in, and convey them to the late ſpring and following ſummer.

Birds that change countries at certain ſeaſons, if they come early, ſhew the temper of the weather, according to the country whence they came: as, in the winter, wood-cocks, fieldfares, ſnipes, &c. if they come early, ſhew a cold winter; and the cuckoos, if they come early, ſhew a hot ſummer to follow.

A ſerene autumn denotes a windy winter; a windy winter, a rainy ſpring; a rainy ſpring, a ſerene ſummer; a ſerene ſummer, a windy autumn: ſo that the air, on a balance, is ſeldom debtor to itſelf; nor do the ſeaſons ſucceed each other in the ſame tenor for two years together.

Mr. Worlidge remarks, that

If at the beginning of the winter the ſouth-wind blow, and then the north, it is like to be a cold winter: but if the north-wind firſt blow, and then the ſouth, it will be a warm and mild winter.

If the oak bear much maſt, it foreſhews a long and hard winter. The ſame has been obſerved of hips and haws.

If broom be full of flowers, it uſually ſignifieth plenty.

Mark well the flow'ring almonds in the wood;
If od'rous blooms the bearing branches load,
The glebe will anſwer to the ſylvan reign,
Great heats will follow, and large crops of grain.
But if a wood of leaves o'er ſhade the tree,
Such and ſo barren will the harveſt be.
In vain the hind ſhall vex the threſhing floor,
For empty chaff and ſtraw will be thy ſtore.
VIRGIL.

This obſervation, ſays Mr. Worlidge, hath proved for the moſt part true for ſeveral years now paſt; as in 1673 and 1674 there were but few nuts, and cold wet harveſts: in 1675 and 1676, were plenty of nuts, and heavy and dry harveſts; but more eſpecially in 1676 was a great ſhew of nuts, and a very hot and dry harveſt ſucceeded.

The exceſſive cold of this winter, ſays M. de la Hire, ſpeaking of that of the year

1709*, in which the thermometer ſunk to 5 degrees on the 10th of January, came on without any conſiderable wind, and what little wind there was, came from the ſouth; and when the wind increaſed and turned to the north, the cold diminiſhed. The mountains of Auvergne, which are to the ſouth of Paris, were at that time all covered with ſnow.

Another ſurpriſing thing was, that notwithſtanding the violence of the cold, the river Seine was not entirely frozen over at Paris, but the middle of it's current continued free, except that there floated in it large pieces of ice: yet in leſs rigorous winters it hath been often ſo frozen, that carriages could paſs over it. The cold of this winter was ſo ſudden, that the ice at the edges, and in the leſſer rivers, was ſo faſt bound at once, that few flakes of it broke off, and they generally fell in the middle of the ſtream; ſo that the violence of the froſt was in part the cauſe that the river Seine was not frozen over.

* *Memoires de l'Academie Royale des Sciences, pour l'an* 1709.

Though the year 1714 was dry, the rain being only 14 inches and $\frac{3}{4}$; yet as there were many thick fogs during the whole of that year, the harveſt was very plentiful, and the fruits were extremely well ripened. Fogs are much more ſerviceable than rains, for the nouriſhment of plants.*

Before I conclude, it may not be amiſs to obſerve, how different the weather ſometimes is in climates not very diſtant. In the year 1751, we had a very rainy ſummer throughout England, and the barometer was very unſettled. At the ſame time an extraordinary drought prevailed in Italy. ‡

At Breſt, in the year 1725, the barometer ſeemed fixed at 26° 4′ from the 2d of February to the 1ſt of September, when it roſe ſuddenly to 28°. The rains were exceſſive; a perfect deluge drowned every thing thereabouts. At the ſame time the weather was, as uſual, changeable at Paris.†

* *Memoires de l'Academie Royale des Sciences, pour l'an* 1714.

‡ Borlaſe's Natural Hiſtory of Cornwall, p. 20.

† *De la Hire, ubi ſupra, pour l'an* 1725.

APPENDIX.

ABSTRACT

OF THE

METEOROLOGICAL OBSERVATIONS

MADE BY THE

Oeconomical Society of Berne,

For the Year 1766.

APPENDIX.

JANUARY.

THIS month was exceedingly cold and dry; the barometer as high as it was ever ſeen; the wind conſtantly N. and N. E. attended with very little ſnow. No rain at Berne. Our lakes were frozen ſo hard, that they bore every kind of carriage without riſk, the ice being ſix inches thick.

The cold penetrated to ſuch a degree, that the wine was frozen in ſeveral vaults; and in our fields and vineyards, the earth was frozen three feet deep. Many vines, eſpecially the old ones, and even cheſnut trees and oaks, were ſplit by the ſeverity of the froſt, particularly on the heights. Where a good deal of ſnow had fallen, the ſprings were not frozen; but in other places they were dried up, by which means the water of the river Aar was extraordinary low.

In the beginning of the month, the froſt was exceedingly ſevere; about the middle, it abated; but towards the end, it ſet in again as hard as at firſt. The ſky was cloudy

during the ſeverity of the cold, and there were frequent fogs.

The crops ſown in the autumn, eſpecially in moiſt ſoils, made a poor appearance. The froſt penetrated leaſt deep in the grounds on which ſcourings of ponds, &c. or marle had been laid; theſe ſubſtances preventing the ſoil's being frozen ſo hard as it would otherwiſe have been.

The paſtures which had been watered were one continued ſheet of ice, and it was feared they would be greatly damaged by it.

Pleuriſies were very frequent during this month. In ſome places dyſenteries began. Some were attacked with apoplexies, violent coughs, rheums, and other diſorders of the ſeaſon. The cattle continued very healthy, except the ſheep, many of which were ſeized with inflammations on the lungs.

FEBRUARY.

THE beginning and end of this month were very cold: the middle of it was ſomewhat milder. The froſt penetrated ſo

deep into the houſes, that the carrots, potatoes, and other plants of this kind were frozen in moſt of our cellars, and in holes dug in the earth for ſheltering them.

The barometer varied greatly, being ſometimes very high, and ſometimes very low.

The wind blew moſtly from the north, and rarely from S. or W. No rain.

The ground under corn looked like a fallow, the blades being quite yellow. It was not till the end of the month that they began to turn green. The great quantities of ſnow deeply frozen in the vallies between the mountains, and in ſhaded places, threatened much danger to the corn.

The damage done to the vines could not be judged of this month, but it was plain they had ſuffered very much; for in places where ſome began to prune them, their wood was yellow and quite dry. The earth could not yet be opened about them.

Some mild days melted the greateſt part of the ice that covered the paſtures, and in the places where that happened they appeared pretty green.

Trees ſuffered exceedingly from the cold, great numbers of them being ſplit. Moſt of the laurels, fig-trees, and roſemary buſhes, periſhed, and ſcarce any thing eſcaped in the gardens.

Notwithſtanding the rigour of the weather, ſtorks appeared towards the latter end of the month, but ſomewhat later than uſual.

The bees did not eſcape the ſeverity of the cold, which killed great numbers of them. They began to go out on the 17th, and their hives were cleaned.

Putrid fevers, pleuriſies, rheums, and inflammations in the throat, prevailed. Few children eſcaped the meaſles. Many ſheep ſtill died.

MARCH.

THE beginning and end of this month were cold; the latter, eſpecially, was rainy and ſtormy: the middle of it was pretty mild and agreeable. The ſnow and ice melted; though it ſnowed a little towards the end of the month. The lake of Bienne

was ſo ſtrongly frozen on the firſt of March, that a carpenter built a ſpacious booth a conſiderable way out upon the ice, and made a very great fire in it. The ice did not become looſe on the ſides of the lake till the middle of the month, and it continued in one entire piece in the middle till the 23d and 24th.

The wind blew generally from the N. E. and N. W. Rain fell to the depth of ½ an inch.

Contrary to all expectation, the young corn looked well. The light and wet ſoils only had ſuffered. Our huſbandmen began to ſow their ſpring crops; but the ſeaſon was ſo cold and wet, that they were obliged to give it up.

The hurt which the vines had ſuſtained from the froſt appeared now more and more: almoſt all thoſe that were ſix or ſeven years old, periſhed. In general, the vines in the plains and light ſoils ſuffered more than thoſe on hanging grounds and ſtrong ſoils. The vine-yards facing the North ſuffered leaſt. The vines bearing red grapes periſhed moſt. Few were yet laid down, the effects

of ſo doing being ſtill very uncertain. Towards the end of the month the pruned vines began to weep, and upon cutting them anew, the wound was of the colour of a rotten apple. The buds fell off in powder with the ſlighteſt touch.

The paſtures remained covered with ice till the middle of the month, when the earth was thawed; but there was yet no verdure even in places free from ice. The firſt violets were ſeen on the 8th.

The gardens, in which ſcarce a plant had eſcaped the ſeverity of the cold, began to be put in order in the beginning of this month.

The cold nights kept back the bloom of the trees. In the ſecond week the apricots began to bloſſom; but they ſuffered much from the cold. Of all the fruit trees, the figs ſuffered moſt from the cold. The other trees were full of bloſſoms. The ſervice trees, which uſually bloſſom in February, were not in bloom this year till the end of this month.

Moſt of the bees periſhed; and we were

obliged to feed thoſe that remained, to preſerve them from the ſame fate.

Putrid fevers and pleuriſies carried off many people; and the ſheep ſtill continued to die.

APRIL.

THE weather was dry and fine during this month, though the nights were a little cold, with a few hoar-froſts. There was frequent thunder, accompanied with cold rains. The N. and N. E. winds prevailed moſt.

The barometer varied but little.

The winter corn in general looked well, and the ſpring corn came up very well every where, the ſeaſon being very favourable.

The paſtures did not recover their verdure till the end of the month. The froſt had deſtroyed the turf in many places. Towards the end of the month, dews and mild rains brought the graſs on very quick.

This month ſhewed us how much the

vines had ſuffered. Half of them had periſhed; in ſome places ſcarce one remained out of forty; and what rendered this loſs the more grievous, was, that the beſt were thoſe which ſuffered moſt. Thoſe which were not deſtroyed, began to bud about the middle of this month; and the roots of thoſe whoſe branches had been killed made ſhoots, from which, however, no fruit could be expected, till after they ſhould be pruned and laid down. The vines were dug round from the beginning of this month.

The ſeeds ſown in gardens roſe but ſlowly, owing to cold winds; and flowers alſo felt the unkindly ſeaſon.

The trees bloſſomed ſurprizingly well. The almonds were in bloom on the 12th. The walnut-trees promiſed well. The cherries were in bloom by the 21ſt, and made a promiſing appearance. Not ſo the apples, and ſtill leſs the apricots and peaches.

Some hives of bees were preſerved by dint of care, and by feeding them.

The nightingale was heard on the 4th,

and the cuckow the next day. The ſwallow appeared at the ſame time.

The ſeaſon ſtill continued ſickly, though few died. All creatures were healthy, excepting that ſome dogs ran mad.

MAY.

FROM the beginning to the end of this month the weather was cold and rainy, with frequent hail. The depth of rain that fell here (at Berne) was 6 inches $\frac{3}{4}$.

The winter corn was thin and ſtinted, owing to the cold and wetneſs of the ſeaſon; though in ſome places it had a better appearance. The ſpring-corn promiſed well, eſpecially on dry ſoils; the ſtrong ſoils being chilled by the frequent rains. The rye was in ear on the 8th, and in bloom on the 20th, when the wheat was not yet in ear. The barley was in ear on the 14th.

The paſtures promiſed but a ſcanty crop of graſs, of which a coarſe ſtrong ſort had taken much the aſcendant; the finer having been checked or deſtroyed by the inclemency of

the weather. The up-land paſtures, or thoſe which had not been watered, promiſed the beſt.

The cold and too much rain did great damage to the vines, and made them ſhoot forked. Many plants of them which were thought to have been killed, began to make ſhoots. The ſmall vineyards fared better than the large.

The fruit was well ſet, and promiſed plenty, though the frequent cold rains made much of it fall off the trees, and caterpillars did here and there conſiderable damage: above all, the fly hurt the peaches in particular. In ſome places, a ſouth-wind did great damage to the apple-bloſſoms.

The young pigs were trained up for fattening; and during the whole month clover was cut and carried to fodder the cattle.

The cold ſeaſon did great injury to the bees, inſomuch that there was not one ſwarm this month, and we were obliged even to feed the weakeſt hives.

The hemp and flax were fine in ſome

places, though not in thoſe where the hail had fallen.

The whooping cough was frequent in the beginning of this month; as were alſo coughs, hoarſeneſs, and oppreſſion on the breaſt; and the diſorder on the lungs of cattle had not ceaſed.

JUNE.

THIS month was as variable as the preceding, the weather being for the moſt part cold and rainy. There were but few fair days. The depth of rain amounted to 4 inches $\frac{5}{6}$, and ſnow fell even on the lower mountains. The North wind prevailed in ſome places, and in others the Weſt.

The winter corn continued very thin, and was full of weeds. The ſpring corn, on the contrary, looked pretty well. Barley began to be reaped on the 23d.

Paſtures, eſpecially the wet ones, yielded but little hay, and that could ſcarcely be made on account of the conſtant rains. The lower meadows were damaged by the over-

flowing of the rivers, which alſo obſtructed the making of hay and getting of it in.

The cold ſeaſon likewiſe threw the vines back very much. The dreſſing of the vineyards was finiſhed with the month. Their firſt bloom appeared on the 14th and 15th, and it was not gone off at the end of the month, owing to the very cold ſeaſon. The very high winds broke off many of their branches.

The cold and wet ſeaſon continued to incommode the cows.

It was equally unfavourable to the bees, though they ſwarmed during the whole of this month.

The fruit fell off the trees in great quantities, and thereby diſappointed our hopes of plenty. The flax and hemp were in great beauty.

Frequent aches were felt every where, and ſome dogs ran mad.

JULY.

THE weather continued very changeable, cold, and wet, during this month. The depth of rain was 6 inches $\frac{3}{4}$. The

wind generally Weſt. The rivers overflowed in moſt places, and did great damage to the hay. In the night of the 10th an aurora borealis appeared, and laſted till late.

On the 10th we began to reap our winter barley, which was rather thin, but the ears were very fine. The winter and ſpring wheat anſwered pretty well; though the former was much laid by the continual rains, which likewiſe rendered it ſmutty in ſome places. Harveſt continued from the middle to the end of this month, and in ſome places till pretty far in the next.

On the 8th was gathered the rape-ſeed, of which there was not above half a crop, owing to the coldneſs of the winter, and to it's bloom having been deſtroyed.

The lower meadows ſuffered exceedingly by their being in general overflowed till the end of this month, ſo that ſcarce any hay could be made on them, and the little that was made was extremely damaged. On the contrary the aftermath, eſpecially on the higher grounds, was very good.

The ſeaſon ſtill continued unfavourable to

the vines. Their bloom did not go off till towards the middle of this month, and the grapes were few and very unequal. A few warm days at the end of the month ſwelled them conſiderably.

The flax and hemp grew very unequally, and were very full of weeds. They were both plucked about St. James's-day.

AUGUST.

THROUGHOUT the whole of this month, the weather was extremely fair and dry. We had not any where above half an inch of rain, and the wind was generally north, which contributed much to the drying of the earth. There was thunder on the 29th, when the lightening burnt a houſe.

The dry ſeaſon favoured the harveſting of oats, which yielded a plentiful crop. The ſpring wheat ran more into ſtraw than corn, and a too ſudden ripening prevented it's plumping. The wheat and meſlin yielded but little when threſhed, and likewiſe at the mill.

It was not till this month that the hay in the lower meadows could be made. The graſs was coarſe, dirty, and rotted in many places; and the aftermaths turned out poorly, having been burnt up by the exceſſive drought.

The grapes were almoſt ſeen to grow in the beginning of this month; but the heat and drought ſtopt their progreſs, and burnt them up. What fruit remained fell off through the drought, and all the walnut, cheſnut, and acorn kind, were ſtinted and looked poorly.

For want of graſs and water, the cows loſt all their milk.

The garden plants, all burnt up and deſtroyed by vermin, were truly piteous to behold.

The whooping cough was frequent among children, and dyſenteries broke out in many places.

SEPTEMBER.

THIS month continued very fair, the wind being chiefly North. Hoar-froſts appeared about the middle of the

month. On the 8th there was a ſuffocating ſouth wind.

A rain which fell in the beginning of the month prepared the earth excellently well for the ſeed time, and rendered it much eaſier to plow, which had been greatly hindered by the drought. The ſeed ſown after this rain roſe very well. The whole of the rain was an inch and a quarter.

The aftermath continued poor in ſome places and was plentiful in others.

The grapes ripened ſuddenly, continued ſmall and little in quantity, the heat having made many fall off.

The gardens and fruit continued in their periſhing ſtate.

The bees yielded little honey.

Beſides the whooping cough, the ſmall-pox ſeized the children, dyſenteries continued here and there, and carried off more children than grown perſons. Many peaſants cured themſelves of this laſt diſorder, by taking an infuſion of rue in milk in which ſome kidney ſuet was melted.

OCTOBER.

THE weather continued very fine during this month. More rain fell in the firſt half of it, than in the laſt. The quantity of it, in all, was 5 ¼ inches. The nights became colder, and the hoar-froſts increaſed. The night of the 31ſt was remarkable for a violent ſtorm of wind with a great fall of rain.

The ſeed time continued to the beginning of this month. The laſt ſown ſeed came up very well. The crop of buck-wheat was but poor. There were but few potatoes on dry ſituations, occaſioned by the drought.

A ſecond crop of hay was cut in ſome places till the middle of this month. The paſtures in general had recovered, and yielded plenty of food, which, in ſome meaſure, ſupplied the want of fodder.

The vintage began on the 13th. But very little wine was made. The apples for cyder were gathered in the beginning of this month.

The bees were in good condition, and their hives heavy.

The dyſentery continued, but without blood.

NOVEMBER.

THIS month was alſo dry and fair. There was little rain (only ½ an inch,) but thick fogs. The wind generally N. and N. E.

Many ſprings were dried up.

The vineyards were dreſſed.

The corn looked well every where, though rather thin in ſome places.

DECEMBER.

THIS month was pretty cold, and the ſky moſtly clouded. The continued drought rendered the waters very low.—Springs which had never been known to fail, were dried up; and many mills ſtood ſtill for want of a ſtream to turn them.

The corn made a fine appearance.

The dreſſing of the vineyards was continued, till a fall of ſnow upon the heights put an end to that work.

The failure of the ſprings prevented the watering of the paſtures in many places: in others the abuſe of that operation proved extremely prejudicial.

From the 16th to the 21ſt a good deal of ſnow fell upon the mountains; and on the 18th the vallies were covered with it.

The bees had ſo little honey, that it was neceſſary to feed them.

THE END.

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